https://doi.org/10.61143/umyu-jafr.4(1)2022.005
ISSN: 2795-3831
E-ISSN: 2795-3823

A REVIEW OF PATIENT SATISFACTION WITH QUEUE MANAGEMENT DURING COVID-19 PANDEMIC. EMPIRICAL EVIDENCE FROM FEDERAL MEDICAL CENTRE GUSAU.

BY

[1]Shamsuddeen Suleiman(PhD)

[2]Muhammad Sani Burodo

&

[3]AbdulAzizMarufAdeniran (PhD)

[1]Department of Mathematical Sciences, Federal University, Dutisn-Ma, Katsina State, Nigeria.

macostamkd@gmail.com

[2]Department of Business Administration and Management Federal Polytechnic Kaura Namoda, Zamfara State, Nigeria.

muhammadsaniburodo@gmail.com

[3]Department of Business Administration, Federal University Gusau, Zamfara State, Nigeria.

amaruf2013@gmail.com

Abstract

The purpose of this study was to determine how well Federal Medical Centre (FMC) Gusau manage queue during COVID-19 pandemic in relation to patient satisfaction. The study used primary data through questionnaire where a sample of 270 registered patients in this hospital were randomly selected and provided with the questionnaires to answer questions but only 268copies of questionnaires were retrieved. The research was conducted between September, 2020 and October, 2020. Queue management was studied using waiting time for service, the waiting environment conditions and service quality in relation to customer satisfaction. Regression analysis was employed in analysing data for the study. The findings indicated that a significant percentage of the patients were dissatisfied with the way queues were managed at Federal Medical Centre Gusau. The results from the regression analysis shows that all the three dimensions of service quality have significant effect with the patient's satisfaction. While service quality, and waiting environment were positively correlated overall satisfaction patients towards service provided at the hospital, but the waiting time had negative effect on the patients' satisfaction.

Keywords- *Covid-19, Waiting Line, Multi-server Queuing theory, Queuing management, service quality, Pandemic, Public Hospital, Over Crowdedness, patient satisfaction.*

1. Introduction

Queues (waiting lines) are common occurrence in daily life, particularly when attending different issues at different service provider like hospitals, supermarket, transit services, businesses, companies and so on. If there is no established queue management system, the situation becomes distressing (Agyei, 2019). A well-managed queue management system in the service delivery industry is beneficial to all stakeholders involved (Liang, 2016; Suleiman, Burodo and Ahmed, 2022). Queuing situations occur in all aspects of work and life and are best exemplified by the process of queuing for services, which involves a group of

ISSN: 2795-3831
E-ISSN: 2795-3823

physical units (people or things). Waiting in a queue or queues under the rules of conduct before some services are rendered on or for each unit in the queue one by one is worrisome to some patients (Burodo, Suleiman and Shaba, 2019).

Waiting time is define as the time spent by the patient in the queue before the commencement of the services (Adeniran, Burodo& Suleiman)

Queuing theory is a branch of mathematics that studies how lines forms, how they function and why they malfunction. Queuing is likely to happen wherever there is competition for scarce resources(Koko, Burodo & Suleiman 2019, 2022; Suleiman and Abdulkadir, 2022).

Queue management is the most crucial part of maintaining the level of patient's satisfaction. Queuing theory deals with waiting lines and its related activities (Burodo, Suleiman and Garba, 2021).

Unfortunately this is not what is experienced in most of our hospitals. Poor adherence to hospitals working ethics, poorly established and/ managed queue management practices and complacency of working staffs might be some of reasons for the delays of services in our hospitals.

Any patient paying a visit to any health facility anticipates receiving effective health care service in the shortest amount of time. Unfortunately, some patients are spending a lot of time on queue before they receive medical treatment. Poor adherence to hospitals working ethics, poorly established and/ managed queue management practices and complacency of working staffs might be some of reasons for the delays of services in our hospitals.

In order to reduce the transmission of the viral disease in the corona virus era, sustained social distancing measures have been required. In other to ensure social distance protocols, healthcare institutions are reducing the size of their working staff, while others are running their outfits base on shift work (Ali & Omar 2020). The potential for creating waiting lines at service delivery points inherent the social distance protocol. Many countries' healthcare centres are already overwhelmed with patients seeking treatment for mild to serious illnesses on daily basis (Nawusu, Danaa and Ismail, 2020). Moreover, COVID-19 has added a further burden on the already strained health systems. Despite an increase in visits, social distancing measures are to be taken. Quick service delivery which is an indispensable need of patients visiting hospitals for treatment is shortened (Ali & Omar 2020).

However, the Nigerian government has drafted stringent regulations to prevent further disease transmission and has urged everyone to strictly abide by preventive measures, controls and quarantine without encountering religious conflict; otherwise, the situation might get worst.

In most healthcare centres particularly in Nigeria, Waiting lines have become a common occurrence and impediment to providing healthcare (Mittal & Sharma, 2020). In addition to losing financial gains, delay and unsatisfactory healthcare could result in high mortality. Health units are dealing with the effective management of staff schedules to reduce the effect of COVID- 19 and cover up capacity to meet the additional demand for health care delivery.

ISSN: 2795-3831
E-ISSN: 2795-3823

Therefore, making an effort to reduce the amount of time spent to receive medical attention is essential. The COVID-19 virus causes infection in the respiratory system of both humans and animals.

In this study, the main purpose is to provide a mathematic perspective to access patient satisfaction with queue management during COVID-19 Pandemic with special reference to Federal Medical Centre Gusau.

Patients must wait before being attended to. Doctors might not be able to examine all the patients properly because of the increased workload. Both patients and doctors are under stress due to long waiting in the OPD and waiting room and eventually leads to heavy workloads from medical professionals. When patient waits more than two hours to receive service and see the doctor, it is generally considered a very long period, especially in the healthcare industry. Thus, this causes a delay in receiving service, which is clearly evident in the number of waiting service seekers to become more and more dissatisfied, which increases the likelihood that they will look for another their discontent, and the possibility of them searching for another party to provide them with service in a shorter time. This may cause the hospital to lose its customers in favour of other hospitals that can better meet their needs. Additionally, this congestion in light of the Corona pandemic posed an extra difficulty, because it is known that overcrowding is known to provide a challenge and not following the rules of social distancing lead to the possibility of infection. Due to the increased prevalence of infection, lack of beds, facilities needed for patient treatment, etc., hospitals are also under tremendous pressure, and the need for PPE kits, masks, gloves, and hand sanitizer has increased significantly. To meet the rising demand for healthcare, hospitals should offer COVID patients a comprehensive readiness plan. An essential aspect that needs to be included in the preoperative plans is the balance of supply and demand, which may be illustrated by the number of patients and resources. Any preparedness plant must prioritize the efficient distribution of resources. Queuing theory provides full application in the assessment of time spent by the user in system and time elapsed in waiting to avail the service.

The main objective of this paper was to determine how waiting line management affects patient satisfaction during COVID-19 pandemic.

However, the specific objectives are as follows:

1) To determine how satisfied patients are with the amount of time they have to wait for a service during COVID-19 pandemic.

2) To ascertain how patients feel about the hospital waiting environment during COVID-19 pandemic.

3) To assess the service quality offered to the patients by the hospital during COVID-19 pandemic.

In an effort to attain these objectives, the following research questions were raised.

ISSN: 2795-3831
E-ISSN: 2795-3823

1) How satisfied patients are with the time they have spent waiting for service during COVID-19 pandemic?

2) How do patients feel about the hospital waiting environment during COVID-19 pandemic?

3) What is the quality of service offered to patients by hospital during COVID-19 pandemic?

2. Literature Review

2.1 Concept of Queuing Characteristics

Different authors/ researchers have stated the queue characteristics using different components. Malik & Belwal, (2016) described that the basic process of a Queueing System comprises of three (3) components: (i) the arrival pattern, (ii) the service pattern and (iii) queue discipline while Noserk Jr and Wilson (2001) indicated that queuing system can be characterized by four (4) components or four main elements: the arrival, the queue discipline, the service mechanism and the cost structure. Stevenson (2009), Krajewski, Ritzman, and Malhotra (2010), Slack, Chambers & Johnston (2010), and Russell and Taylor (2011) also stated four (4) components: (i) population source/ calling population, (ii) arrival and service patterns, (iii) number of servers (channels) and (iv) queue discipline (order of service/ priority rule). Taha (2001) On the other hand stated that queuing systems are characterized by five (5) components: The arrival pattern of customers; the service pattern, the number of servers, the capacity of the facility to hold patients, and the order in which the patients are served. In this study the four most commonly used components stated by the above mentioned authors will be adopted.

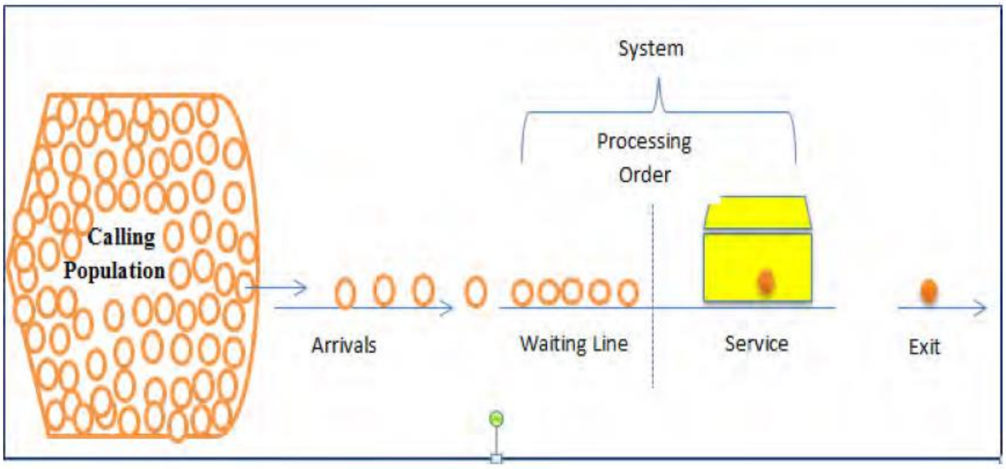

Figure 2.1: A Simple Queuing System

(Source: Developed by Stevenson, William J., (2009), Operations Management, 10th edition)

ISSN: 2795-3831
E-ISSN: 2795-3823

I. The Calling Population/ Population Source

There are two types of population sources: population with an infinite source and population with a finite source finite source. In an **Infinite source situation,** the potential number of patients greatly exceeds the capacity of the system. Anytime a service is unlimited, infinite source situations exist (Stevenson, 2009). An infinite patient population on the other hand, is one in which the number of patients in the system does not affect the rate at which the population generates new patients (Krajewski, Ritzman, and Malhotra 2010). When the potential number of patients is limited, a **finite-source situation** exists (Stevenson, 2009). Therefore, with a finite source of patients the probability of a customer arriving depends on the number of customers already being serviced.

II. Arrival and Service Patterns

The rate at which patients arriving at the hospital need to be served by the server (medical doctor) is known as the arrival rate or pattern (Slack, Chambers & Johnston, 2010). It refers to the method by which units (patient) joined the queues; it may be static or dynamic, depending on the patient arrival rate and service facility. The inter-arrival time often defines the patient's arrival process (the time between successive patient arrivals to the service facility). It could be random with a known probability distribution or it could be deterministic (known exactly). According to the Poisson distribution which a discrete probability distribution that often describes the arrival rate in queuing theory, the arrival process can be regular arrival meaning that that patients arrive at a service facility according to some known schedule (Heizer & Render 2011). When they are independent of one another and their occurrence cannot be precisely predicted, it could be in a completely random manner (Heizer& Render 2011). Additionally, it might arrive singly or in batches, non-stationary or generally independently (Bakari, Chamalwa& Baba, 2014).

Behavior of Arrivals

Heizer and Render (2011) stated that most queuing models assume that a person who arrives is a patient. The arriving unit are people or machines that wait in the queue until they are served (or attended to) and do not switch between lines. Unfortunately, the fact that people have been known to balk or to renege complicates life. Patients who **balks** refuse to join the waiting line because it is too long to suit their needs or interests. **Reneging** patients are those who enter the queue (waits in line) but then become impatient and leave without receiving treatment. Another scenario that could also exist is rejecting (Slack, Chambers & Johnston, 2010). **Rejecting** – if there are many patients in a queue more than the maximum number permitted, then the patients could be rejected by the system.

III. Number of Servers (Channels)

The facility that deals with the patients in the queue is known as server. In any queuing system, there may be a large number of servers configured in various ways (Slack, Chambers & Johnston, 2010). According to Krajewski, Ritzman and Malhotra (2010), the number of lines and the arrangement of facilities can be used to describe the service system. Waiting lines may be designed to be a single line or multiple lines. Service facilities consist of the personnel and equipment required to provide the service for the patient. Service facility

ISSN: 2795-3831
E-ISSN: 2795-3823

arrangement is described by the number of channels and phases. The number of parallel servers available is equal to the number of **channels** in a queuing process. On the other hand, the number of **phases**, indicates the number of sequential servers each patient must go through to complete the service (Russell & Taylor, 2011). While some services only need a single phase, while others require a series of phases. Patient in the **single-channel, single-phase** system form a single queue and pass through the service facility one at a time and are attended to by a single server facility. Under the **single-channel, multiple-phase** arrangement patients are required to form a single line and go sequentially from one service facility to the next (performed in sequence by more than one facility).

Contrarily, the **multiple-channel, single-phase**, arrangement on the other hand requires customers form more than one line, depending on the design, and provides the same/ different services at more than one facility. The **multiple-channel, multiple-phase** arrangement occurs when customers can be served by one of the first-phase facilities but later need service from a second-phase facility, and so on (Krajewski, Ritzman and Malhotra, 2010).

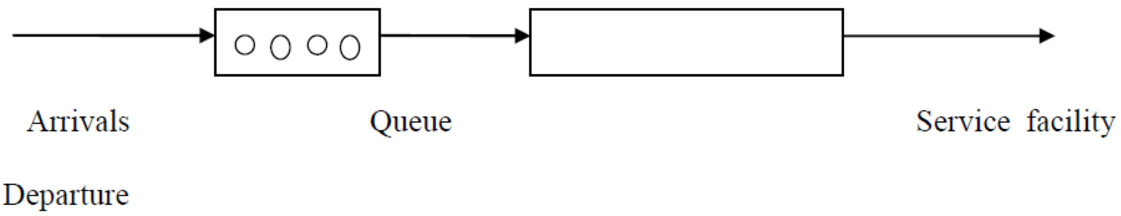

Figure 2.2 Single Channel Facility

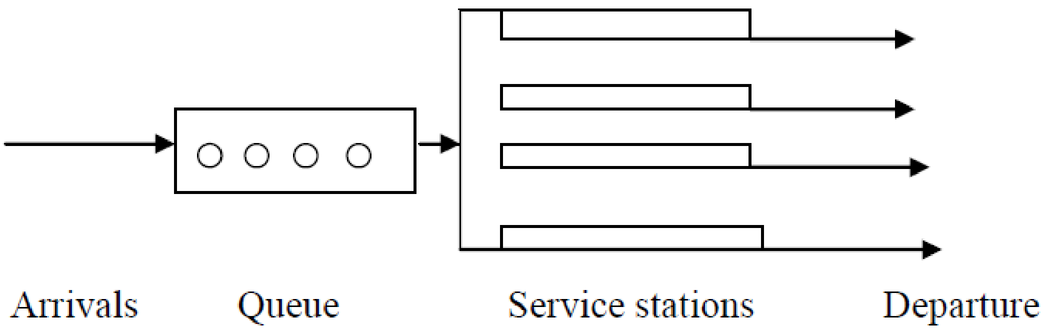

Figure 2.3 Multiple, Parallel Facilities with Single Queue

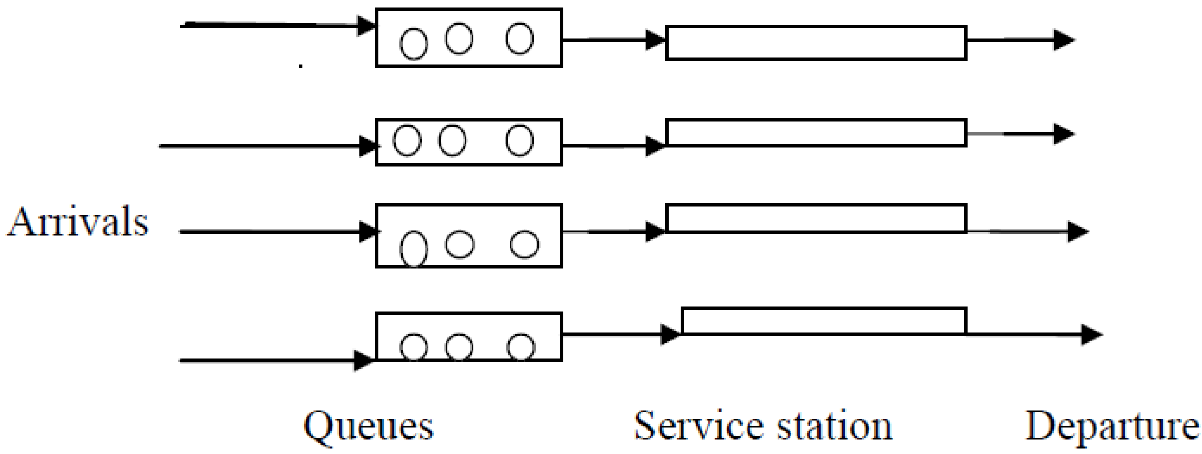

Figure 2.4 Multiple, Parallel Facilities with Multiple Queues

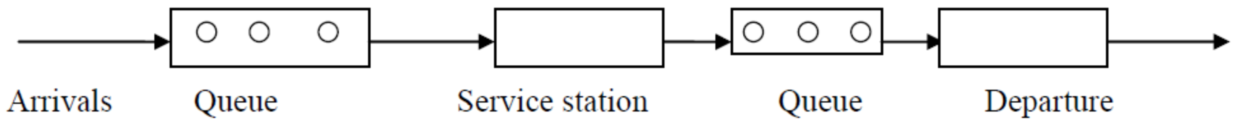

Figure 2.5 Service Facilities in Series

IV. Queue Discipline (Order of Service/ Priority Rule)

The **queue discipline** is the order in which waiting patients are served. The most common form of queue discipline is **first come, first served,** which states that the first person or item waiting in line will be served first (Krajewski, Ritzman& Malhotra, 2010; Russell & Taylor, 2011; Heizer & Render, 2011). There are other disciplines as well such as **last in, first out** (the last part is selected first), **random selection** (select one at random from the full parts), or according to **predetermined schedule** (patients are scheduled for service according to a predetermined appointment/ prearranged schedule regardless of when they arrive at the facility) (Russell and Taylor, 2011).

Moreover, the priority disciplines might also consider the patient with the **earliest promised due date** (EDD) or the customer with the **shortest expected processing time** (SPT) or a **preemptive discipline**, which allows a patient of high priority to interrupt the service of another patient (e.g. in emergency rooms, patients with the most life-threatening injuries receive treatment first, regardless of their order of arrival (Krajewski, Ritzman and Malhotra 2010).

2.2 Review of Empirical Studies

An empirical review of authorities who conducted studies in the area of discussion is required to support the claims of any study, there is need for. However, the following studies of a similar nature were reviewed:

ISSN: 2795-3831
E-ISSN: 2795-3823

Khan et al (2021) conducted a research on improving the performance of reception and OPD by Using Multi-Server Queuing Model in Covid-19 Pandemic. The aim of this research paper was to examine the performance of current queuing system and offer solutions on how to achieve its optimum service level during the Covid-19 pandemic. The present data was acquired in two steps. The first step was to collect the data from reception.While the 2nd step was to gather the data from OPD. Data included variables like arrival rate, service rate and wage of the front desk staff and the variables consisted of service times of the different customers concerning see different physicians sitting at the OPD. Moreover, the salary of appointed medical doctors and waiting cost of the patients were additionally gathered.

The Rockwell Arena software was used to import the data and reveal its dispersion. When it was validated that arrival and service distribution of people followed the poison and exponential distribution respectively, then the ordinary arrival and service rate were put into TORA optimization software in addition to the variety of doctors. Performance measures were determined by the assistance of TORA optimization software application. In last the acquired performance measures were taken into MS succeed for estimation of cost and outlining graphs. Since there were already 10 doctors; they calculated performance measures and cost analysis were done and the results showed that 2 more doctors should be hired. As a result of the aforementioned decision, the system utilization decrease from 86.6% to 72.2%.The time spent by patients in the system reduce from 0.238 hours to 0.178 hours; and the probability of the system to remain idle increased from 1.2% to 1.6% [3]. This research study was only carried out on the medical OPD; it can additionally be conducted in all the OPDs of hospital in order to improve the healthcare delivery at public healthcare. The seasonal analysis of queuing system of the OPDs can also be carried out.

Ali et al (2021) conducted a study on the Application of Multi-Server Queuing Model to Analyze the Queuing System of OPD during Covod-19 Pandemic. This study is aimed at suggesting the optimum service level of queuing system of reception and the outpatient department during COVID-19 pandemic. The data was collected from the reception and OPD of the ABC public hospital of Hyderabad. The arrival times, service times of patients and number of doctors and receptionist at the workplace, their salaries and waiting cost of patients were all included in the data collection. Input analysis of patients` arrivals and service was conducted by in input analyzer of Rockwell Arena software. TORA optimization software was adopted for the calculation of performance measures. Various costs of queuing system were calculated in MS Excel and the required graphs were also plotted. Therefore, the study recommended that one receptionist and one doctor should be increased to bring optimality in the queuing system and patients` flow. Moreover, waiting cost of patients should be decreased to greater extent.

Ahmed and Abdelgadir (2021) applied waiting lines models in Al-Hikma Hospital in Khartoum State. This paper is aimed at solving the problem of waiting clients using queue models. The study used primary data through observation method. The results of the analysis revealed that waiting of patients in the circumstances of the new Corona virus has health consequences related to the nature of the virus and the way it spreads. This necessitated the

ISSN: 2795-3831
E-ISSN: 2795-3823

application of other measures to prevent congestion and waiting. The findings also revealed that the waiting period for customers is long compared to known waiting standards despite the application of some rules such as the appointment system and restriction on a spatially attending hospitals for emergency cases only. The study therefore recommended the need to increase the number of service providers, but cost benefit analysis has to be taken into consideration. Moreover, conduct studies related to patient satisfaction, and constantly survey the work environment to avoid any shortcomings. Furthermore, there is need to observe known global protocols through follow-up and training.

Adesina, Stephen and Alexander (2021) conducted a study on Globalisation of Diseases: The Challenges of COVID-19 Pandemic and Public Health System in Nigeria. In essence, infectious diseases such as COVID-19, are easily transmitted across the countries of the world through the network created by globalisation poses serious challenges to the world health system, particularly developing countries such as Nigeria. Public health system in Nigeria is overwhelmed by the consequences of the COVID-19 pandemic, which further exposes the country to the adverse effects of globalisation such as dependence and unequal relationship between her and the developed countries. Even though the challenging situation provides Nigeria an opportunity to overhaul her public health system, the current poor global economy has further worsened the problems. This current study analysed the situation, and recommended that Nigerian government should develop Public health system in a more sustainable way. Moreover, the economy should be repositioned to reduce the level of dependence, and resources should be redirected to adequately fund education and research to support the health sector.

Mittal and Sharma, (2020) Studied the Probabilistic Model for the Assessment of Queuing Time Of Corona virus Disease (Covid-19) Patients Using Queuing Mode. To determine patient waiting time in hospitals for the confirmation of disease, the queuing theory was applied for the multi-server system. In order to estimate the time it will take to detect and identify diseases under severe loading conditions, this study provides a sequential queuing model. The objective is to propose a simplified probabilistic model to determine the general behaviour to predict how long the treatment cycle takes to diagnose and categorise the infected individuals. The law of the isolated logarithm is proved for this type of method, demonstrating that the general process of recognition is consistent right of iterated logarithm. The numerous measurement criteria are shown graphical representations in some cases. The findings of the modelling revealed that the waiting time for patients in the course of studies, detections, detecting or treatment of corona viruses will increase according to the logarithm rule.

2.3. Theoretical Review

This section discusses theory related to effect of patient satisfaction with queue management during COVID-19 pandemic. This theory is applied in so as to justify the choice of the research topic.

ISSN: 2795-3831
E-ISSN: 2795-3823

2.3.1. The Queuing Theory

A Danish engineer named A. K. Erlang was acknowledged as the father founder of queuing theory. Erlang experimented with fluctuating telephone traffic dem and in 1909. He published a report addressing the delays in automatic dialing equipment eight years later. The early work of Erlang was extended to more general problems and to business applications of waiting lines at the end of World War II.

The practical problem of congestion served as the driving force behind Erlang's work and of others, in the 1920s and 1930s.A notable example is the works of (Molina, 1927; Fry, 1928). During the next two decades, several theoreticians became interested in these issues and developed general models that could be applied in more complex situations. Authors like Crommelin, Feller, Jensen, Khintchine, Kolmogorov, Palm, and Pollaczek are among those who made significant with contributions. Books by these authors contain a detailed explanation of the study of queuing theory (Syski, 1960;Saaty, 1961). The study of purely discontinuous processes by Kolmogorov and Feller's laid the foundation for the later development of the theory of Markov processes.

Queuing models are usually divided into two types: descriptive, which describe the current real-world situation (for example, how long one has to wait in the queue), and prescriptive, which prescribe what should be done in order to achieve a particular situation (for example, what should be done to minimize customer waiting time). Most research which has been done in the area of queuing theory concerns descriptive models. However, there has also been some work done in the field of optimization problems which prescribe the optimal course of action to follow (Bonga, 2014; Patel *et al.*, 2012). This area of research is referred to as the patient satisfaction with queue management during COVID-19 pandemic. In general, which parameters are to be optimized depends on how the system has been modelled and which parameters are under control (Bonga, 2014).

2.3.2. Theoretical Framework

After a thorough analysis of pertinent theoretical model, this study carefully considered descriptive and prescriptive models of queuing theory which allows for the creation of an acceptable and thorough justification by establishing a direct or categorical relationship between the assumptions and the justification for research.

The mean waiting time in the queue, mean service time, utilization of service facilities, distribution of the number of patients in the queue, distribution of the patients in the system, probability waiting time in the queue and other related queuing parameters all can be determined with the help of queuing model for patient satisfaction with queue management during COVID-19 pandemic with a special reference to Federal Medical Centre Gusau.

Queuing theory is the appropriate model that can explain the assumptions of the study and it is upon the theory's assumptions that this research is hinged on.

ISSN: 2795-3831
E-ISSN: 2795-3823

3. Methodology

In this study, a descriptive research design was employed. It is the type of research that focuses on the characteristics of a particular individual, or of a group, event or situation (Mbogo et al, 2012).

The study employed primary data through structured questionnaires. Most of the questions in the questionnaire were in likert scaled (see Appendix). The scales of the questions were authenticated using Cronbach alpha reliability statistics. Cronbach's alpha results were within the acceptable range of 0.70 to 0.95 (Tavakol & Dennick, 2011) as presented in Table 1.Patients who attend the Federal Medical Centre Gusau were randomly administered with questionnaires. The population of patients who have registered with Federal medical centre Gusau as at time this research was undertaken was 812 patients. The minimum sample size recommended for the population by the sample size calculator is 261. The study distributed 270 copies of questionnaires out of which only 268 were duly returned. The study used descriptive statistics inform of percentages and frequencies. Regression analysis was employed as an inferential statistics in this study. The data obtain from the questionnaires was analysed using graphs, frequencies and regression analysis. Graphs and frequencies were obtained using Microsoft excel and regression analysis results were obtained using SPSS packages.

Regression analysis was used to analyse relationship between service quality components and Patients' satisfaction. Determinants of patients' satisfaction were grouped in to waiting time, waiting environment and service quality to assess the patient's satisfaction status as shown in Figure 1.

The regression equation model used in this study can be specified as follows:

The regression equation model for this research can be specified as follows:

$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon (1)$

Where

X_1 = Waiting time

X_2 = Waiting environment

X_3 = Service quality

ε = Error term (residuals)

ISSN: 2795-3831
E-ISSN: 2795-3823

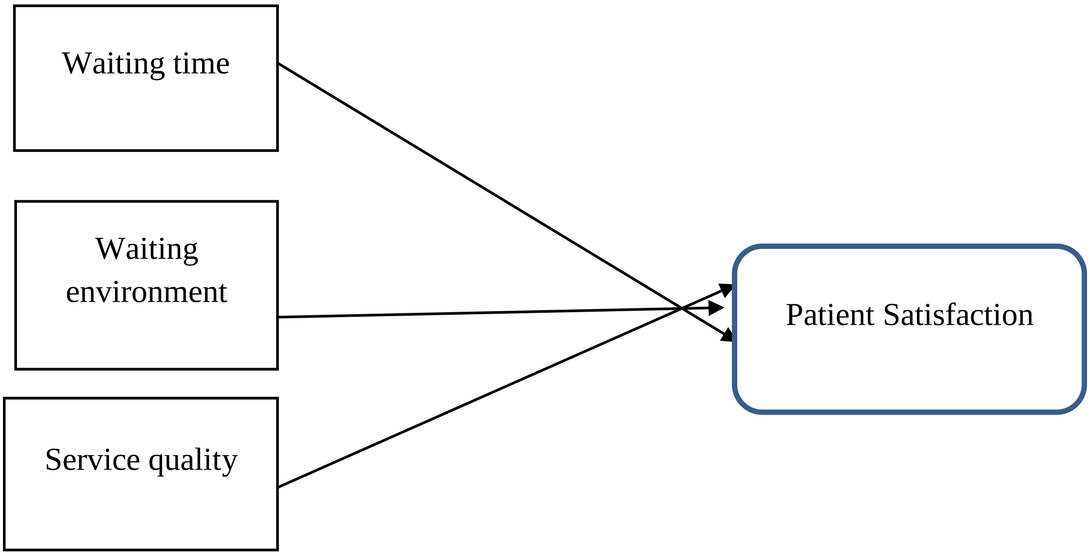

Figure 1: Model Structure

Table 1: Summary of Cronbach's alpha results

Section	No .of items	Cronbach's alpha
Waiting time	6	0.831
Waiting environment	6	0.715
Service quality	6	0.803

4. Results and Discussion

Table 2: Waiting time

Are happy with the service time	Freq	Percent (%)
No	164	61.3
Yes	104	42.7
Total	268	100.0
How do you rate the service time	**Freq**	**Percent (%)**
Very fast	19	7.0
Fast	53	19.8
Moderate	99	36.8
Slow	73	27.3
Very slowly	24	9.1
Total	268	100.0
Have you ever turned away due to longer time taken to be serviced	**Freq**	**Percent (%)**
No	160	59.8
Yes	108	40.2
Total	268	100.0
balked (turn around and left)	**Freq**	**Percent (%)**
No	165	61.6
Yes	103	38.4
Total	268	100.0

ISSN: 2795-3831
E-ISSN: 2795-3823

How would you describe the time you spent waiting for service at the Hospital	**Freq**	**Percent (%)**
Too long	44	16.3
Long	99	37.1
Moderate	84	31.4
Very short	10	3.8
Short	31	11.4
Total	268	100.0

Table 2 indicates the opinions of the respondents on waiting time, it shows that 164(61.3%) patients were unhappy with the service time in the hospitals and 104(42.7%) patients expressed happiness with the service time in the hospital. This obviously shows that the majority of patients were not happy with services at the hospital. It also indicates that 19 (7.0%), 53(19.8%), 99(36.8%), 73(27.3%) and 24(9.1%) patients assessed service time as very fast, fast, moderate, slow and very slow respectively. This undoubtedly shows that the majority of patients assessed service time between fast and moderate. Majority of patients 160(59.8%) have never turned away due to longer time taken to be serviced. Similarly, more than half 165(61.6%) never balked due to longer waiting and service time. Respondents' description on time spent waiting for service at the hospital indicates that 44(16.3%), 99(37.4%), 84(31.4%), 10(3.8%) and 31(11.4%) as too long, long, moderate very short and short respectively. This evidently shows that the majority of patients spent long time waiting for services at the hospital.

Table 3: Waiting Room Information

Statement	**SA**	**AG**	**UD**	**DA**	**SD**
The waiting room is specious and big enough	17(6.3)	113(42.2)	2(0.7)	104(38.9)	32(11.9)
The waiting room is well ventilated	21(7.8)	105(39.2)	0(0.0)	109(40.6)	33(12.4)
There are enough chairs and/ benches in the room for Patients to sit while waiting for service	21(7.8)	60(22.5)	3(1.2)	146(54.3)	38(14.2)

SA=strongly agree, AG=Agree, UD=undecided, DA=disagree and SD=strongly disagree

Table 3 indicates that patients were largely fulfilled with the spacious nature of the waiting room and patients seem to have been dissatisfied with both waiting room ventilation and number of chairs and/ benches in the room for Patients to sit while waiting for service.

ISSN: 2795-3831
E-ISSN: 2795-3823

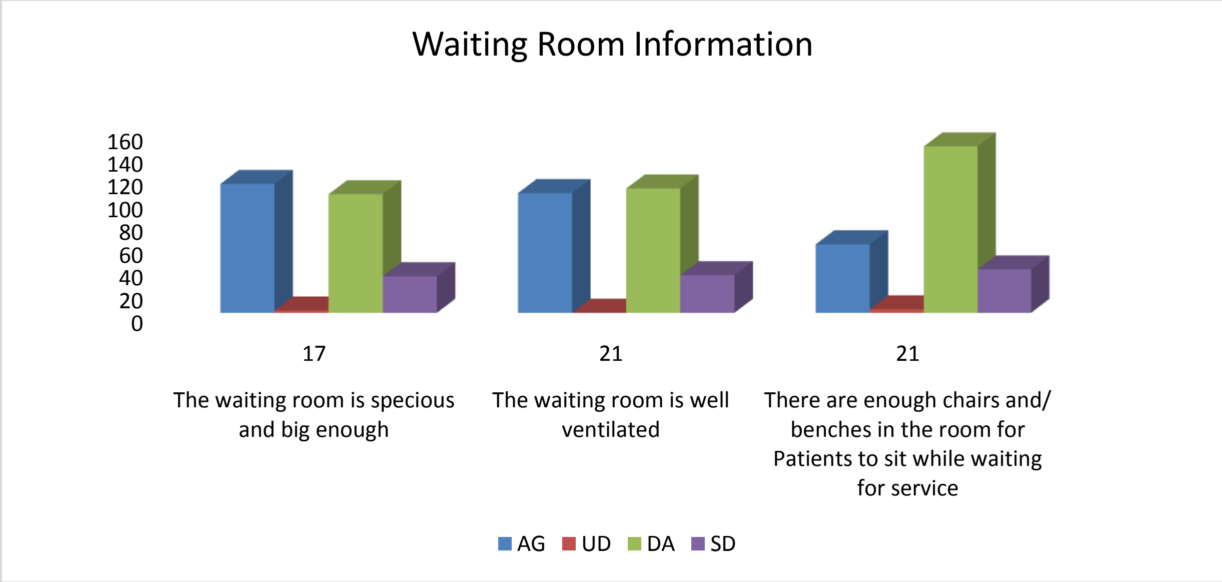

Figure 2: Bar chart of Waiting Room Information

Table 4: Queue Management

Statement	SA	AG	UD	DA	SD
Queues are managed properly at the hospital	24(8.8)	87(32.6)	0(0.0)	113(42.1)	44(16.5)
There are barriers to guide patients in queues	52(19.4)	118(44.2)	2(0.8)	82(30.6)	13(5)
Hospital staffs are of great help in helping patients in queues	33(12.4)	65(24.3)	3(1)	108(40.2)	59(22.1)
Queue discipline follows FCFS pattern mostly (i.e the first to arrive will be serviced firstly	43(15.9)	70(26.2)	0(0.0)	101(37.7)	54(20.2)
Generally I am satisfied with how patients are handled at the hospital while waiting for service	36(13.3)	67(24.9)	0(0.0)	136(50.6)	30(11.2)

SA=strongly agree, AG=Agree, UD=undecided, DA=disagree and SD=strongly disagree

Table 4 indicates that queue management are managed improperly at the hospitals and there are barriers to guide patients in queues. Similarly, patients have to some extent disagreed that hospital staffs are of great help in helping patients in queues, queues discipline follows FCFS pattern mostly (i.e the first to arrive will be serviced firstly). The table also indicated that the patients are generally dissatisfied with how they are handled at the hospital while waiting for service.

ISSN: 2795-3831
E-ISSN: 2795-3823

Table 5: Patients level of satisfaction

Statement	VS	SA	NT	US	VU
How would you rate your experience with hospital personnel?	15(5.7)	108(40.3)	2(0.6)	124(46.4)	19(7)
Generally how satisfied are you with the hospital service?	11(4.3)	77(28.7)	0(0.0)	134(49.9)	46(17.1)
How satisfied are you with the waiting room environment?	29(10.9)	50(18.8)	0(0.0)	126(47.1)	62(23.2)

VS= very satisfied, SA=satisfied, NT=Neural, US=unsatisfied and VU=very unsatisfied

Table 5 indicates that more than half of the patients (respondents) have expressed dissatisfaction with the hospital services.

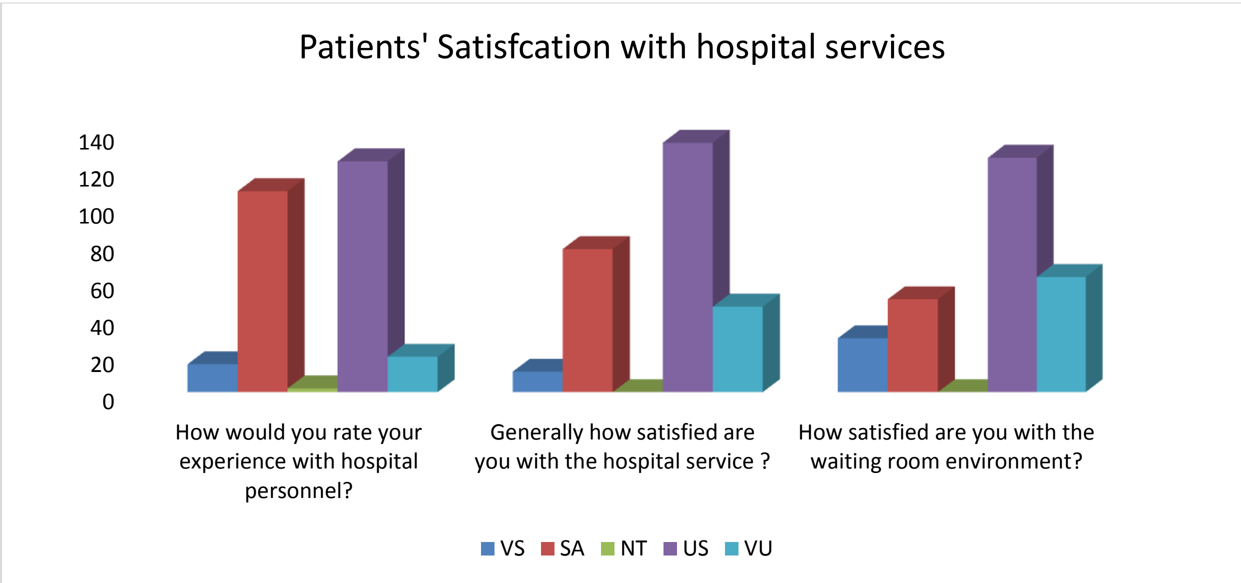

Figure 3: Bar chart of Patients' Satisfaction with hospital services

Regression analysis Results

Prior to regression analysis, multivariate normality, multivariate linearity, extreme values and ties among the independent variables were checked. Royston's and Mardia's tests were applied to check if data follows multivariate normal. Results from both tests confirmed that the assumption of multivariate normality is met (see table 5) since at 5% level of significance, the null hypothesis of multivariate normality is accepted. Scatter diagram matrix in figure 4 suggests that all the variables met linearity assumption. When correlations are examined in table 6, it is found that none of its coefficients is greater than 0.8 which indicates absence of multicollinearity among the variables. Similarly, since none of variance inflation factors (VIF) is not equal or higher than 10 is an indication of no multiple correlations among

ISSN: 2795-3831
E-ISSN: 2795-3823

the variables. Table 7 indicates significant positive correlations between patients' satisfaction with both waiting environment and service quality but negatively and significantly correlated waiting time. This means that patients are more satisfied with better waiting environment and service quality.

Table5.Test for normality Using Royston's test and Mardia'stest

Test	Royston's	Mardia's	
		Skewness	Kurtosis
Test Statistics	1.477	0.981	0.215
p-value	0.153	0.19	0.769

Figure 4: Scatter Diagram Matrix

Table 6: correlations and collinearity statistics

	Zero-order	**Partial**	**Part**	**Tolerance**	**VIF**
Waiting time	0.151	0.281	0.225	0.065	1.413
Waiting environment	0.209	0.239	0.237	0.092	1.854
Service quality	0.119	0.193	0.181	0.061	2.415

Table 7: multiple regression coefficients

	B	**Std error**	**Beta**	**T**	**P-values**
Constant	-0.031	0.057		-0.545	0.586
Waiting time	-0.253	0.051	-0.253	-4.933	0.000
Waiting environment	0.292	0.057	0.291	5.125	0.000
Service quality	0.658	0.059	0.636	11.552	0.000

Conclusion

In this study, queue management analysis of Federal Medical Centre Gusau was investigated. Patients' perceptions of how queues are managed in the hospital indicated that a substantial percentage of them were not satisfied. Results from patients' opinion indicated that the Patients relatively wait for a long time to be served, waiting rooms were relatively

ISSN: 2795-3831
E-ISSN: 2795-3823

not spacious enough, not well ventilated and not having enough chairs for the patients to sit and wait for services. Regression analysis results also indicated that there was a negative relationship between waiting time and patients' satisfaction, positive relationship between waiting environment and patients' satisfaction, a positive relationship between service quality and patients' satisfaction. Therefore, patients believe that better service quality and more conductive waiting environment give them more satisfaction. However, they believe that more waiting time gives them less satisfaction. The findings of this study can be used as a guideline by the hospital management and government to improve the service quality program in the hospital. Specifically, the hospital management should consider recruiting more medical and non-medical staffs in order to reduce waiting time at the hospital, government should endeavor to build more offices and patients' hospital rooms and furnish them appropriately.

ISSN: 2795-3831
E-ISSN: 2795-3823

References

Adeniran AM, Burodo MS, Suleiman S.(2022). Application of Queuing Theory and Management of Waiting Time Using Multiple Server Model: Empirical Evidence From Ahmadu Bello University Teaching Hospital, Zaria, Kaduna State, Nigeria, *International Journal of Scientific and Management Research*; 5(4):159-174, DOI http://doi.org/10.37502/IJSMR.2022.5412.

Adesina A.S., Stephen O. S. and Alexander P. M (2021) Globalisation of Diseases: The Challenges of COVID-19 Pandemic and Public Health System in Nigeria. *The Nigerian Journal of Sociology and Anthropology,* Volume 19, No. 1

Agyei A. (2019) An Assessment of the Relationship Between Waiting Lines and Customer Satisfaction of Commercial Banks in Techiman Municipality, International Journal of Recent Scientific Research, 10(9),34588-34593

Ahmed O. I. A. and Abdelgadir M. E. A.(2021). Applying Waiting Queue Models to Solve Queue Problems During the Corona Pandemic in Khartoum State Hospitals. *International Journal of Innovation, Creativity and Change*. www.ijicc.net Volume 15, Issue 3.

Ali k. M., Khaskheli S.A, Kalwar A. H, Muhammad A. K,Marri H.B and Nebhwani M(2021). Application of Multi-Server Queuing Model to Analyze the Queuing System of OPD during Covod-19 Pandemic: A Case Study, *Journal of Contemporary Issues in Business and Government*, Vol. 27, No. 05.

Ali, I., and Omar M L A., 2020. COVID-19: Disease, management, treatment, and social impact. The science of the total environment, 728(2020): 138861.

Bakari, H., Chamalwa, H. and Baba, A., (2014). Queuing Process and Its Application to Customer Service Delivery (A Case study of Fidelity Bank Plc, Maiduguri). *International Journal of Mathematics and Statistics Invention*, Vol 2, No. 1, pp.-14-18

Bonga W. G. (2014). An Empirical Analysis of the Queuing Theory and Customer Satisfaction in Small and Medium Enterprises: A Case Study of Croc Foods. PhD Thesis in conomics with Atlantic International University based in Zimbabwe.

Burodo M.S., Suleiman S. and Garba Y *(2021).* An assessment of Queue management and Patient Satisfaction of Some Selected Hospitals in North-Western Nigeria. *International Journal of Mathematics and Statistics Invention (IJMSI), Volume 9 Issue 8, PP 14-24*

Burodo M.S., Suleiman S. and Shaba Y. (2019), Queuing Theory and ATM Service Optimization: Empirical Evidence from First Bank Plc, Kaura Namoda Branch, Zamfara State American Journal of Operations Management and Information Systems; 4(3): 80-86. doi: 10.11648/j.ajomis.20190403.12

ISSN: 2795-3831
E-ISSN: 2795-3823

Centers for Disease Control and Prevention. COVID-19 Overview and Infection Prevention and Control Priorities in non-US Healthcare Settings. Accessed 12 August 2020 Available:https://www.cdc.gov/coronavirus/2019-ncov/hcp/non-ussettings/ overview/index.htmlCOVID-19. Chinese Journal of Epidemiology, 41.

Desta A. l.Z. andBalete T.H.(2019). The Influence of Waiting Lines Management on Customer Satisfaction in Commercial Bank of Ethiopia, Financial Markets, Institutions and Risks, 3(3), 5-12

Fry, T. C. (1928), “Probability and its Engineering Uses”, Van Nostrand Co.

Gao, W.J., Zheng, K., Ke, J., and Li, LM, (2020). Advances on the asymptomatic infection of

Ghana Health Service. COVID-19, Ghana’s outbreak response management updates. Accessed 15 May 2020 Available:https://ghanahealthservice.org/covi d19/archive.

Heizer, J. & Render, B., (2011). Operations Management: Global edition. 10th ed. New Jersey: Prentice Hall/ Pearson education Ltd.

Khan M. A, Khaskheli S.A, Kalwar A. H, Muhammad A. K, Marri H.B and Nebhwani M (2021). Improving the Performance of Reception and OPD by Using Multi-Server Queuing Model in Covid-19 Pandemic, *International Journal of Science and Engineering Investigations*, vol. 10, issue 113,

Koko M.A., Burodo M.S. and Suleiman S. (2019). Queuing Theory and Its Application Analysis on Bus Services Using Single Server and Multiple Servers Model. American Journal of Operations Management and Information Systems. 3(4), 81-85.doi: 10.11648/j.ajomis.20180304.12

Krajewski, L., Ritzman, L. and Malhotra, M., (2010). Operations Management: Processes and Supply Chains. Ninth Ed. New Jersey: Pearson Education, Inc.

Liang, C.-C. (2016). Queueing management and improving customer experience: empirical evidence regarding enjoyable queues. Journal of Consumer Marketing, 33(4), 257–268.doi:10.1108/jcm-07-2014-1073

Malik, N. & Belwal, O. K., (2016). Application of Queuing Theory to Patient Satisfaction at Combined Hospital, Srinagar Garhwal Uttarakhand. *International Journal of Science and Research*, Vol. 5, No. 4, pp. 1621-1624.

Mittal, H., and Sharma, N., (2020). Assessment of Delhi NCR Traffic Using Queuing Model. *International Journal of Advanced Science and Technology*, 29(7), 5418-5424.

Molina, E. C. (1927), “Application of the theory of probability to telephone trunking problems”, Bell System Tech. J. 6, pp. 461-494.

Nawusu YAW, Najim U. An application of queuing theory to ATM service optimization: A case study. IISTE - Journal of Mathematical Theory and Modelling. 2014;4 (6).

ISSN: 2795-3831
E-ISSN: 2795-3823

NosekJr, R.A. and Wilson, J.B., (2001). Queuing Theory and Customer Satisfaction: A Review of Terminology, Trends and Applications to Pharmacy. *Hospital Pharmacy*, No. 36, pp.275-279.

Patel, J., Rajeshkumar, M., Pragnesh, A., Makwana, P., (2012). Minimize the waiting time of customer and gain more profit in restaurant using queuing model. *International conference on management, humanity and economics* (ICMHE 2012), p77-80

Pollaczek, F. (1934), "Uber das Warte problem", Math. Zeitschrift, 38, pp. 492-537.

Pollaczek, F. (1965), "Concerning an analytical method for the treatment of queuing problems", Univ. of North Carolina, Chapel Hill, pp. 1-42.

Russell, R. and Taylor, B., (2011). Operations Management: International Student Version. 7th ed. New Jersey: John Wiley & Sons, Inc

Saaty, T. L. (1961), "Elements of Queueing Theory and Applications", Mc-Graw Hill Book Co., New York.

Slack, N., Chambers, S. & Johnston, R., (2010). Operations Management. 6th ed. Harlow, England: Pearson/Prentice Hall.

Stevenson, W., (2009). Operations Management. 10th edition, New York: McGraw-Hill/Irwin.

Suleiman S, Abdulkadir Y. (2022). Partial Least Square Structural Equation Modelling (PLS- SEM) of Patient Satisfaction on Service Quality in Katsina Public Hospitals, *Asian Journal of Probability and Statistics*; 17(3):49-60. DOI: 10.9734/ajpas/2022/v17i330426

Suleiman S, Burodo MS, Ahmed Z (2022). An Application of Single and Multi-server Exponential Queuing Model in Some Selected Hospitals of the North-Western Nigeria, *Asian Journal of Probability and Statistics*; 16(2):1-9. DOI: 10.9734/AJPAS/2022/v16i230396.

Suleiman S., and Usman U.(2016) prediction of Customer Accessibility of Electronic Banking logistic regression in Nigeria, Equity Journal of Science and Technology, 4(1): 93 97

Syski, R. (1960), "Introduction to Congestion Theory in Telephone Systems, Oliver and Boyd", London.

Taha A.H (2001), *Operation Research: An Introduction*, 7th Edition, Hall India World Health Organization. Corona virus disease (COVID-19). Accessed 03 June 2020 Available:https://www.who.int/docs/defaultso urce/coronavirus/situation reports/ 20200306-sitrep-46- covid19.pdf? sfvrsn =96b04adf 4

Tavakol M. &Dennick R.(2011). Making sense of Cronbach's alpha, *International Journal of Medical Education*, 2:53-55, DOI: 10.5116/ijme.4dfb.8dfd