

# AN EMPIRICAL STUDY ON APPLICABILITY OF WAITING LINE MODEL IN SELECTED HOSPITALS

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## ABSTRACT

*The objective of the present study is to examine the applicability of waiting line model in various hospitals of southern Rajasthan. It also investigates the implementation level of waiting line model as innovation tool for patient satisfaction because this model helps to reduce waiting time and it turns it makes a good image of the hospital. Furthermore an attempt has been made to study that delay in services is the biggest issue in the healthcare industry and patients are not ready for wait to acquire the services, due to impatience or may be emergency case. The findings suggest that the implementation of waiting line model in health care or in hospital will give positive aspect of the patient as well as for hospital image.*

*This study is intended to examine the applicability of waiting line model in various hospitals of southern Rajasthan. This part of Research describes about the composition of the process, tools, methodology adapted to carrying out the objectives of the study undertaken.*

**Key Words:** - Waiting Line Mode, Healthcare, Accident and Emergency, Hospitals, Queuing Theory, Healthcare Industry etc

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Healthcare System in India and around the world has witnessed a phenomenal growth during last three decades. The basic reason behind raising this industry is the increasing rate of population and their demand for the healthcare service. So, health care systems have been challenged in recent years to deliver services to all the patient and high quality services with limited resources without delay. This issue for healthcare industry is a bottleneck issue because delay in service may result in death of a patient and congestion results into mismanagement of resource distribution and allocation to patient or staff members of the hospital as well. Health care resources are becoming increasingly limited and expensive, thereby placing greater emphasis on the efficient utilization of the resources and the corresponding level of service provided to patients.

To resolve the service delays and patient congestion like issues the restructuring and renovation was performed, but in some region the restructuring and renovation have produced a serious overcrowding effect such that patients wait for hours to see doctors or before attention particularly in emergency departments (ED) and intensive care units (ICU). Management of waiting, delays and unclogging bottlenecks requires the assessment and improvement of flow between and among various departments in the entire hospital system.

Therefore, Researchers around the world have become more focused on service industries in general and healthcare in particular. Government regulations, public-private participation, competition amongst hospitals and patient satisfaction urge hospital administrators to find ways to manage congestion and decrease waiting times (both waiting time in the hospital as well as the waiting lists that exist outside the hospital). Current health care literature and practice indicate that waiting lists and congested patient flows are indeed made up of one of the most important problems in healthcare industries.

In order to improve performance in an environment as complex as a hospital system, the dynamics at work need to be understood, of which queuing theory provides an ideal set of instruments for such understandings. Queuing theory was developed to study the queuing phenomena and for analysis and modeling of processes that involve waiting lines. This study presents the applicability of these techniques more widely across the healthcare system. Results show that the application of operations research (queuing model in particular) brings greater versatility, variety and control to the management of healthcare organization.

According to recent studies conducted, the customer's (patient) aspirations are fast changing. Customers are growing more aware of their health needs, demand quick response, less waiting times, and above all - demand nearness of the healthcare unit to them.

However, since waiting line is part of our daily life, all we should hope to achieve is to minimize its inconvenience to some acceptable levels. The customers' arrival and service times don't know in advance otherwise the operation of the facility could be scheduled in a manner that would eliminate waiting completely. For this purpose, to reduce the time delay trained personnel and specialized equipments are required, study in this research paper with the help of queuing system.

### OBJECTIVES OF THE STUDY

Waiting line model or applicability of queuing theory is a relatively new concept in the Indian hospital industry with special reference to Rajasthan hospitals. As of the studied literature of queuing theory few researches are there related to its applicability in the hospital sector. So main purpose of this research study is to examine the applicability of waiting line or queuing theory is to analyze the congestion of patients in private and public sector hospitals.

- To assess the applicability of Waiting Line Model in proper Management of hospitals.
- To present the waiting line model's mathematical computation for reception counter of the study area's public and private hospitals with reference to indoor and outdoor patients.
- To take responses from selected patients about their level of patient satisfaction.

### ➤ REVIEW OF RELATED LITERATURE

By the opinion of **Dahl et al. (2006)**, Wait lists remain one of the most significant problems facing our health care system. The importance of reducing waits has been raised in numerous health care reports. In the 2004 federal Throne Speech, the government stated that "the length of waiting times for the most important diagnoses and treatments, is a litmus test of the health care system and these waiting times must be reduced." Normally acute and long-term care beds are in short supply in hospital operating rooms are underused, diagnostic equipment is lacking, emergency department waits are too long and physicians and other health professionals are too few.

**Fomundam et al. (2007)** described the contributions and applications of queuing theory in the field of healthcare. They summarized a range of queuing theory results in areas of waiting time and utilization analysis, system design and appointment system.

An empirical study conducted by **Creemers et al. (2007)** found that the capacity and variability analysis in a healthcare environment results in queuing models that are different from queuing model in industrial settings. He also showed the relationship between the capacity utilization, waiting time and patient (customer) service.

According to **Biggs (2008)** Elective surgery waiting lists are used to manage access to public hospital elective surgery services and give priority to those in most urgent need of care. They have become an integral feature of our health system, and allow limited health resources to be allocated or 'rationed' on the basis of need. Waiting lists also provide health consumers with an indication of how long they can expect to wait for their surgery.

Queuing theory is a very volatile situation which causes unnecessary delay and reduce the service effectiveness of establishments. Apart from the time wasted, it is also leads breakdown of law and order. Many lives and property had been lost in queues at filling stations in the past. (**Adeleke, Ogunwala, Halid 2009**),

**Schoenmeyr et al. (2009)** analyzed that healthcare organizations function with very small net margins, so decisions about committing resources must be made with a high degree of confidence that the investment will lead to the desired result. The queuing approach is useful because it enables the investigation of future scenarios for which historical data are not directly applicable.

Waiting times assist in measuring the rate of turnover on hospital waiting lists and are considered a more reliable indicator of hospital performance than the size of the waiting list. In some cases the patient may be removed from a waiting list. Reasons may include that they no longer require the procedure, are instead admitted as an emergency patient, receive their treatment at a different hospital or are transferred to the waiting list of a different hospital, are untraceable or die.

**Agrawal & Saxena (2010)** analyzed the use of queuing theory in the healthcare Centre of IIT-K and the benefits accrued for the same and they conceptualize an appointment system in which customers who are about to enter service may have a probability of not being served and may rejoin the queue. In their investigation, they found that the capacity utilization is 76%, average number of people waiting in the queue is 2.57calculated by the Poisson distribution method.

As Examined by **Mehandiratta (2011)** with rapid change and alignment of the health care system, new lines of services and facilities to render the same, severe financial pressure on the health care organizations and extensive use of expanded managerial skills in healthcare setting, use of queuing models has become quite prevalent in it. Queuing models are used to achieve a balance or tradeoff between capacity and service delays.

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## ➤ RESEARCH METHDOLOGY

The nature of the research design is such that the hospitals were identified through judgmental and random sampling procedure. The researcher has used his judgment at two levels: One at the level of selection of hospitals among various hospitals located in districts and second at the level of selecting the department and units to examine the applicability of waiting line model.

The judgment for selection of hospitals has been pertained to: the size and scale of hospital, locality of the hospital, and availability of all types of treatment with modern technology, public awareness, and cost applied in treatment. As far as the units and department of hospitals is concerned, the judgment pertained to the size and scale of unit, nature of responsibility, patient turnover, services offered.

A list of participating hospitals is given in Table 1 This list is district wise hospital's name of both private and public / government sector.

**Table 1:** Participating Hospitals in Research

S. No.	District	Type	Name of Hospital
1	Udaipur	Private	G.B.H. American Hospital, BhattJi Ki Bari, Udaipur
		Public	Maharana Bhopal General Hospital, Nr. Chetak Circle
2	Banswara	Private	Laddha Hospital, Sindhi Colony, Banswara City
		Public	General Hospital, Banswara
3	Chittor	Private	Aruna Hospital, Rajeev Colony, Chittorgarh
		Public	Govt. Hospital, Keli, Chittor
4	Bhilwara	Private	M.G. Hospital, Bhilwara
		Public	General Hospital, Bhilwara
5	Rajasmand	Private	Sharma Hospital, Jal-chakki Road, Rajasmand
		Public	Kamla Nehru Hospital, Bhilwara Road, Kankroli

Source: - Survey

### RELIABILITY FOR DATA COLLECTED

The reliability coefficient tested by using Cronbach's alpha ( $\alpha$ ) analysis. In order to measure the reliability for a set of two or more constructs, Cronbach's alpha is a commonly used method where alpha coefficient values range between 0 and 1 with higher values indicating higher reliability among the indicators

### RELIABILITY ANALYSIS - SCALE (ALPHA)

#### For Indoor Patients

Number of Cases = 142.0

Cronbach Alpha = .8176

#### For Outdoor Patients

Number of Cases = 132.0

Cronbach Alpha = .7433

**Table 2: List of Variables and Measures which may persuade patients**

Construct	Variable	Measured Used
<b>Facilities and Services</b>	Variable 1	Parking
	Variable 2	Drinking Water
	Variable 3	Electricity
	Variable 4	24 hrs service
	Variable 5	Free treatment
<b>Infrastructure</b>	Variable 6	Building
	Variable 7	Capacity
<b>Specialty</b>	Variable 8	Research Lab
	Variable 9	Specialist Doctors
	Variable 10	Hi-tech OT
<b>Operational Services</b>	Variable 11	Clean and Hygienic
	Variable 12	Technology for treatment
	Variable 13	Directional guidelines
<b>Functional Activities</b>	Variable 14	Availability
	Variable 15	Record maintenance

**Source:** - Questionnaire, Primary data

Degree of relationship was studied by Pearson's correlation between mediating variables, facilities and services, infrastructure, specialty, operational service and functional activities for indoor and outdoor patients.

**Table 3: Evaluation of Relationship between variables persuades indoor and outdoor patients**

Type of Patient	Measure of Significance of Relationship between variables		
	Highly Significant	Significant	Insignificant
<b>Indoor Patient</b>	Facilities & services - infrastructure, facilities & services - specialty, facilities & services - functional activities, infrastructure - specialty, infrastructure - operational services, infrastructure - functional activities	Specialty - operational services, specialty - functional activities, operational service - functional activities	Facilities & services - Operational Services
<b>Outdoor Patient</b>	Facilities & services - specialty, Infrastructure - specialty, Infrastructure - operational services, Infrastructure - functional activities, Specialty - operational services, Specialty - functional activities, Operation services - functional activities	Facilities & services - functional activities	Facilities & services - infrastructure, facilities & services - specialty

Table 3 describes that correlation between constructs and depicts highly significant, significant and insignificant correlation for both indoor and outdoor patients separately.

To analyze the **consequences for different constructs between hospitals and Indoor and Outdoor patients** various hypotheses were established and analyzed through Two-Way ANOVA. The hypotheses were formulated on the basis of:

1. Constructs shares common attributes for all the ten hospitals in study area.
2. Constructs shares common attributes for both Indoor and Outdoor patients.
3. There is no relation for constructs in hospitals and Indoor and Outdoor patients.

The consequences of Two- Way ANOVA test for all the constructs for indoor and outdoor patients of selected hospitals of the study area is shown below. This representation will show that variation in construct is whether significant for outdoor and indoor patients or not.

**Table 4: Two-Way ANOVA analysis of constructs and their significance for Indoor and Outdoor patients**

Constructs	Measures of Significance	
	Significant	Insignificant
Facilities & Services	Yes	-
Infrastructure	Yes	-
Specialty	Yes	-
Operational Services	Yes	-
Functional Activities	Yes	-

Above table 4 depicts that variation in any of the construct is significant for both indoor and outdoor patients in the selected hospitals in the study area.

**All the related dimensions of constructs for indoor and outdoor patients** of selected hospitals have been analyzed further using T-test. This test helped to identify that is there a significant difference in dimension of constructs between indoor and outdoor patients.

1. There is no significant difference for facilities and services and its measures between indoor and outdoor patients. But these variables are more important for indoor patients.
2. There is no significant difference in infrastructure and its measures between indoor and outdoor patients. However, infrastructure and capacity variables are more important for indoor patients.
3. There is a significant difference for specialty and its measures between indoor and outdoor patients. However, these differences for specialty, research lab were not found to be non-significant. In case of differentiation, factors specialist doctors and Hi-Tech OT are more important for the indoor and outdoor patients. In these factors specialist doctors is an important variable for outdoor patients and for indoor patients Hi-Tech OT is more considerable variable.
4. There is a significant difference for operational services and its measures between indoor and outdoor patients. This difference in technology for treatment was not found to be non-significant. In case of differentiation, factors, operational services clean & hygienic, directional guidelines were more important for the indoor and outdoor patients. These factors are important variables for indoor patients in comparison to outdoor patients.
5. There is a significant difference for functional activities and its measures between indoor and outdoor patients. In case of differentiation, factors, functional activities, availability of resources and record maintenance system were more important for the indoor and outdoor patients. These factors are important variables for indoor patients in comparison to outdoor patients.

The analysis on the **effectiveness of factors responsible for choosing a hospital** by patients shows that good will and reputation, specialty and due to emergencies are highly significant factors responsible for choosing a hospital by patients. The result of corporate tie ups has been found non-significant, which means still less patients are aware about the corporate tie ups of hospitals and even did not check this issue.

Principal component factor analysis was used **for analyzing the opinions of patients** as well about hospital and related issues like service and facilities offered by it. For indoor patients there were 34 issues and for outdoor patients there were 26 different statements and four doctors there were 33 statements / parameters taken and put into component analysis test. The consequences are as follows:

**Outdoor Patients:** After analyzing outdoor patients' opinions four factors were extracted. In which factor 1 is associated with infrastructure, factor 2 is associated with services and facilities offered by hospitals, factor 3 is associated with the availability of resources and services and factor 4 represents behavioral measures of hospital staff.

**Indoor Patients:** After analyzing indoor patients' opinions four factors were extracted. In which factor 1 is associated with infrastructure, factor 2 is associated with services and facilities offered by hospitals, factor 3 is associated with the availability of resources and services and factor 4 represents specialty and approached of hospital for indoor patients.

#### ➤ ANALYSIS OF OPINIONS FOR HOSPITAL AND RELATED ISSUES:

A hospital and its management deliver various facilities, services and benefits to doctors and patients visited for treatment. For indoor patients, outdoor patients and doctors these services and related issues are classified under various statements with the purpose to identify the opinion of patients and doctors about them. All the statements are asked to give a rank according to the defined Likert scale technique. For indoor patients there were 34 issues and for outdoor patients there were 26 different statements and for doctors there were 33 statements / parameters. To analyze these statements or parameters principal component analysis method is applied; the results are in the following tables.

**Table 5: Hospital Parameters and Outdoor Patients Opinions**

Parameters	Components			
	1	2	3	4
Private hospitals are better than public hospitals	.696*	.333	-.635	.542
Parking facility is proper and convenient	.992*	-.034	-.013	.286
The hospital has access to good infrastructure with the proper directional department	.828*	-.122	.129	-.145
Properly attended by reception counter and provides all related information in a polite manner	.342	.958*	.238	.493
The waiting room capacity in the hospital is adequate and according to the necessities	.790*	-.501	-.288	-.381
Hospital campus is clean & hygienic	.833*	.658	-.127	.461
Sufficient number of Doctors are available in all departments of the hospital	-.638	-.003	.712*	.326
Doctors are available in hospitals for 24 hours	.658	-.127	.738*	-.232
Doctors patiently respond and give enough time to diagnose problems	.634	.267	-.628	.691*
The specialist Doctors team is available for extreme cases and diseases	.084	-.526	.821*	-.123

Latest technology is used for better treatment	.256	.356	-.712	.598*
Emergency cases are attended with priority	-.210	.827*	.292	.223
24 Hours of drinking Water in the hospital	.333	.512	.905*	-.326
Adequate number of Oxygen cylinders in hospital	.575	.191	.053	.976*
Availability of wheel chair in the hospital	.162	.041	.785*	-.216
Availability of medicines and bandages in the hospital	-.318	-.098	.817*	-.496
Availability of clean and hygienic wash rooms in the hospital	.290	.496	.905*	-.098
Availability of Para medical staff in hospital	.117	.404	.889*	.292
Specific guidelines are prescribed by the doctors for the next visit	-.526	-.292	.516	.876*
Availability of electricity at all times	-.301	.664	.691*	.463
Availability of Free facility (e.g. Medicine provided by government is easily available to needy patients)	.348	.791*	-.260	.314
Availability of all facilities under one roof.	-.415	.586*	.361	.014
Free treatment facility for BPL patients	-.398	.756*	-.226	-.113
Record maintenance processes are computerized	.928*	.669	-.096	-.057
Application of Information Technology (IT)	.876*	.839	.454	.621
Extra charges taken by staff members from patient	-.098	-.041	.587	.723*

**Source:** Primary Data [Analysis made by IBM SPSS 19.0]

**Extraction Method:** Principal Component Analysis [4 Components extracted]

From the analysis, four factors are extracted which are associated with the facilities and services delivered by hospitals and its management to outdoor patients. From analyzing the twenty six different parameters the IBM SPSS 19.0 extracted four factors that are:

**Factor 1:** These parameters are associated with the infrastructural facilities or services that are incorporated mainly to the hospitals identity that what are the opinions of outdoor patients about the infrastructure of hospital and related parameters.

**Factor 2:** These parameters are associated with the services and facilities that are mainly delivered or provided to the outdoor patients from the hospitals.

**Factor 3:** This factor covers the issues related to the availability of resources and services. And also helps to identify which parameters are significant for patients in terms of treatments and emergency?

**Factor 4:** This factor represents the behavioral measures of hospital staff and administration with outdoor patients. It also covers that hospitals is caring about their patients so it confirms the guidelines and latest techniques for treatment.

**Table 6: Hospital Parameters and Indoor Patients Opinions**

Parameters	Components			
	1	2	3	4
Private hospitals are better than public hospitals	.868*	.147	.599	.195
Parking facility is proper and convenient	.691*	.664	-.301	.019
The hospital has access to good infrastructure with the proper directional department	.972*	-.183	.007	.413
Attendance of the patient by the receptionist at the hospital	.398	.839*	-.260	-.248
Hospital campus is clean & hygienic	.822*	.504	-.236	-.159
Doctors are available in all departments of the hospital	.095	-.396	.882*	-.225
Doctors are available in hospitals for 24 hours	.297	-.411	.972*	.365
Doctors frequently visit when required	.036	.742*	-.502	.411
Complicated cases of patients consulted with a specialist team of doctors	-.142	-.335	.095	.664*
Advanced technology is used for the treatment	.126	-.719	-.016	.280*
Major concern is given to the emergency cases	.297	.925*	-.689	.456
Diet provided by the hospital to the patients	-.198	.972*	.095	.362
Number of rooms are available in Hospital for patients	.742*	.598	.452	-.042
Number of beds available in hospital for each patient	.280*	-.719	-.411	-.196
Accessibility of drinking Water in hospital at all times	.321	.095	.856*	-.198
Convenience of Ambulance in hospital	.331	.972*	.425	-.212
Access of Oxygen cylinders in hospital	-.394	-.411	.662*	.565
Availability of Blood in hospital for all times	.167	.141	.472*	-.365
Availability of wheel chair in hospital	-.497	-.423	.556*	-.225
Availability of medicines and bandages in hospital	.239	.111	.632*	.418
Enough availability of Operation Theatres	.114	-.074	.456*	.327
Availability of Clean and hygienic wash rooms in hospital	-.019	-.522	.666*	-.228
Availability of Para medical staff in hospital	.414	.489	.724*	.561
Availability of Bed sheets, blankets, pillows in hospital	.387	-.623	.698*	.222

Availability of electricity at all times	.141	.326	.745*	.624
Monitoring instruments are maintained in hospital	.806*	.761	-.496	-.389
Availability of Free facility (e.g. Medicine provided by government is easily available to needy patients)	.365	.586*	-.612	.014
Availability of all facilities under one roof.	-.523	.741*	-.171	-.564
Free treatment facility for BPL patients	-.415	.366*	.238	.014
Record maintenance processes are computerized	.741*	.127	-.514	.363
Application of Information Technology (IT)	.992*	-.034	-.513	.446
Extra charges taken by staff members from patient	.542	.426	-.635	.696*
Timely discharge by the Hospital after complete treatment, without delay	.266	-.334	-.616	.492*

**Source:** Primary Data [Analysis made by IBM SPSS 19.0]

**Extraction Method:** Principal Component Analysis [4 Components extracted]

From the analysis of above Table 5.16, four factors were extracted which are associated with the facilities and services delivered by hospitals and its management to indoor patients. From analyzing the thirty three different parameters the IBM SPSS 19.0 extracted four factors that are:

**Factor 1:** This factor includes parameters that are associated with the infrastructural facilities or services that are incorporated mainly to the hospitals identity that what are the opinions of indoor patients about the infrastructure of hospital and related parameters. It covers all the dimensions of the infrastructural structure of a hospital designed for patient's facilitation.

**Factor 2:** This factor includes parameters that are associated with the services and facilities that are mainly delivered or provided to the indoor patients from the hospitals. It covers the dimensions of services and opinions of patients about their delivery to them.

**Factor 3:** This factor covers the issues related to the availability or resources and services. And also helps to identify which parameters are significant for patients in terms of treatments and emergency? It signifies how frequently a service can be procured by patients.

**Factor 4:** This factor represents the measures for specialty and approaches of hospital for indoor patients. It also covers that hospitals is caring about their patients so it confirms the guidelines and latest techniques for treatment. It represents the behavior of hospital staff with patients and how timely the staff delivers facilities or services to their patients.

**Table 7: Patients Opinion on Segments of Hospitals Requires Improvement**

Statement	Indoor / Outdoor	N	Mean	Std. Deviation	T-value	P-value
Technology (Equipments)	Indoor	140	3.85	1.05	0.926	0.946
	Outdoor	129	3.21	1.12		

Number of Doctors	Indoor	132	4.18	0.95	0.058	0.494
	Outdoor	118	4.08	0.84		
Number of paramedical staff	Indoor	142	3.07	1.26	1.09	0.277
	Outdoor	132	3.21	1.12		
Parking and Transportation	Indoor	140	4.03	0.92	0.921	0.218
	Outdoor	130	4.08	0.9		
Reception Counter	Indoor	114	4.36	0.76	0.02	0.011*
	Outdoor	120	4.31	0.73		
Doctors availability	Indoor	127	4.12	0.98	1.912	0.641
	Outdoor	123	4.36	0.82		
Behavior of Paramedical staff	Indoor	141	3.96	0.83	2.138	0.897
	Outdoor	132	4.26	0.78		
Others	Indoor	110	3.98	0.76	1.05	0.042*
	Outdoor	107	3.93	1.08		

\*Significant at.05 Levels

#### Source: - Primary Data

**Table 7**, explains that the results are significant for all the eight segments defined in a questionnaire that patients asks for the improvement and these areas must be carefully treated. Significant differences are found between indoor and outdoor patients for reception counter (0.011) and other (0.042). The segment others cover issues like clean & hygienic, guidelines, 24 hrs services availability, staff availability, special consideration of emergency cases, etc. For the rest of purposes, no significant differences are found among indoor and outdoor patients.

**Table 8: Patients Opinion on Segments of Hospitals Requires Improvement**

Statement	Indoor / Outdoor	N	Mean	Std. Deviation	T-value	P-value
Technology (Equipments)	Indoor	140	3.85	1.05	0.926	0.946
	Outdoor	129	3.21	1.12		
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**Source: - Primary Data**

## CONCLUSIONS

In present scenario, rapid growth of technologies is increasing expectation of patients in the health care environment, which is recognized as customer satisfaction a measure of quality. In the delivery of medical service, individual patient needs, expectations and experiences will undoubtedly vary for several of reasons. Knowledge of the use of waiting line model / queuing model to determine system parameters is of value to health providers who seek to attract, keep and provide quality health care to patient in the ever-competitive “marketplace”.

Queuing theory is one of the most prevailing and tested mathematical approach which can be used for analyzing waiting line performance parameters for health care centers. Effective application of the model can help to improve access to quality at any unit of hospital system which is viewed as key to increase quality with special reference to resource utilization, availability of facilities & services, waiting time reduction and queue management methodologies. It is worth mentioning that queuing models are not the end in itself in decision making, they are just the beginning of the structuring of decision making framework.

There are various reasons like rate and nature of patient’s arrivals and patient severity, etc. are the cause of fluctuation and variation in the healthcare system which directly or indirectly affects the service quality and are outside the control of the hospital management. Providing patients with timely access to appropriate medical care is an important element of high quality care which invariably increases patient satisfaction, when care is provided is often as important as what care is provided. Don’t we think providing medical services to expectant mothers, in a setting where the worry and burden of waiting time management was reduced or even eradicated, keeps patients happy and decreases the anxiety of the doctors.

## SUGGESTIONS

This study attempts to study the applicability of waiting line model in the health care system to measure its effectiveness and to identify the relationship between the servers and waiting lime delays. So the overall composition of the thesis focuses on mathematical analysis of queuing model and other important analysis, which works on identified constructs that persuades patients and their opinions.

The recommendations for improving the service quality, reducing the patient waiting time and increasing the satisfaction of patients could be classified under administrators, patients and doctors head.

### **SUGGESTIONS FOR PATIENTS**

Generally, improvement in the patient flow, systematic service available to patients and reduction in service delay time for patients can be achieved by following ways:

1. Patients should follow the guidelines published by hospitals and doctors on the information board.
2. Should follow proper appointment time frame assigned to you to visit a doctor or to avail a service like report collection.
3. Should be very careful for the uses of resources like electricity, water, etc., should not waste the resources.
4. Should be aware about the camps organized for awareness related to specific diseases.
5. Relatives and others should follow the visiting hours for patients and doctors as well.
6. Should be sensitive towards the uses of free facility provided by hospital administration or government as well.
7. Should contribute to keep the hospital clean and clear.
8. Be care full for the notices and information published on the information board.
9. Be cooperative with the hospital management for managing the resources and facilities.
10. Systematic and proper treatment is Patient's right.

It is worth mentioning that a good infrastructure technologically upgraded unit, systematic patient flow improves patient satisfaction by quality services and reduced time delays. A good patient flow reduces waiting time when resources are sufficient according to the flow of patient, so the length of patient's queues must be optimized. It is true that it is very crucial to determine the exact requirements of patients, but a historical analysis can make them to ready for optimal determination of servers.

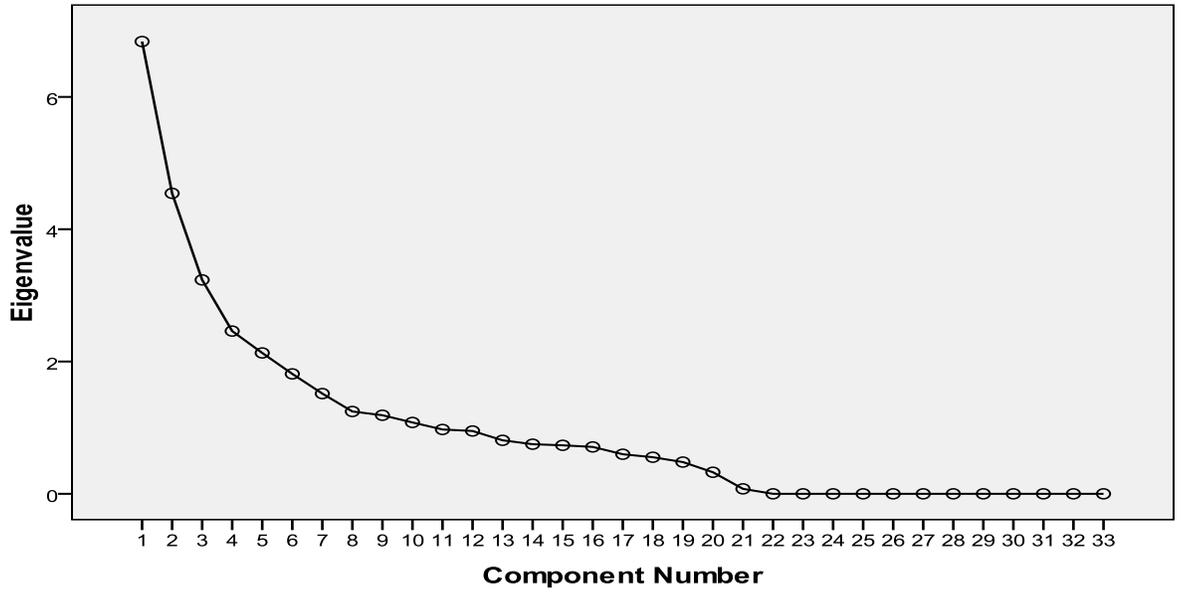
A proper computerized record management system must be in every hospital for exact identification of patients with their relevant details like age, gender, reason for visit, reason of admission, time, reason for discharge, treatment provided, ward number etc. so that quality of services can be assured at timely manner. A systematic record keeping process helps to achieve various performance parameters related to service quality and patient satisfaction. This also helps to determine service performance parameters such as an arrival rate, length of stay, probability of delay, average time spent in the queue and the system, the number of patients in queue and system and rate of rejection or turn-away.

Evaluation of the capacity of a hospital directly related to utilization of available resources and services offered to a patient, where excess or improper management generates hurdles and problems in facilitation. A hospital management can perform cost- benefit analysis on the basis of patient turn in rate that whether to increase the resource availability or not. It also helps to identify opportunities for increased efficiency and effectiveness through synergy. Also, shortage or inadequate manpower and modern technology needs to be addressed by the government for both hospitals.

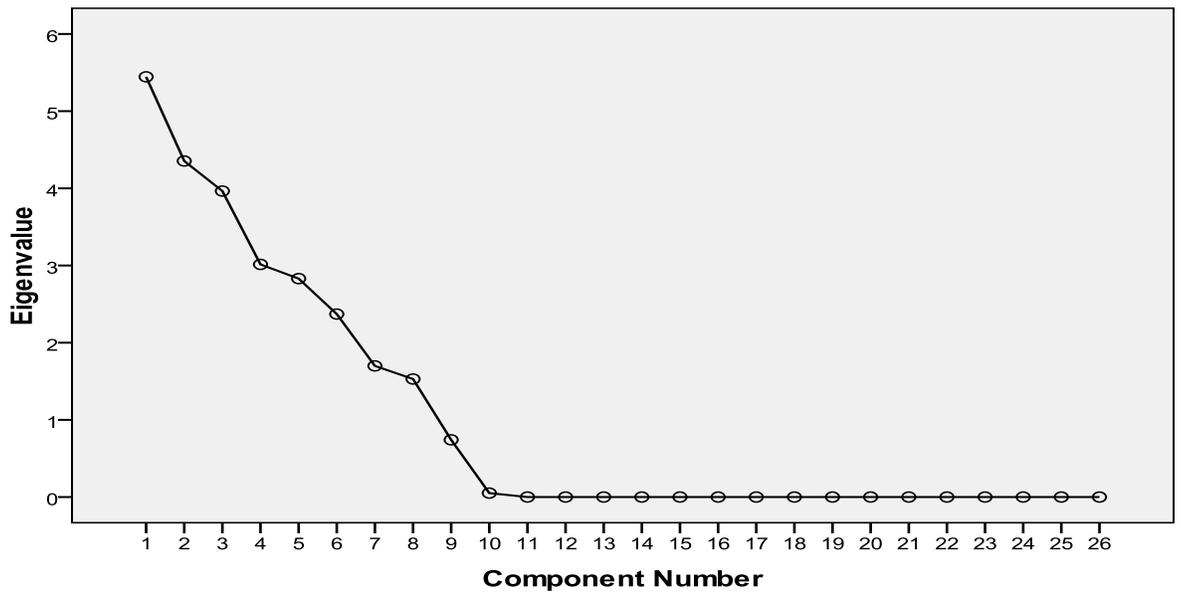
Furthermore, hospital management should reveal various unidentified issues in front of researchers so that researcher could develop a model to facilitate the issue to improve the service quality and delivery. A proper cooperation with researcher and policy makers may definitely give a proper direction to service delivery. They should know that relationship between size and quality of service is a vital issue in capacity planning. Also important is quality information concerning cost structures and revenue characteristics and how these affect capacity and resource allocation decisions.

Scree plots

Scree Plot



Scree Plot



**References:-**

Adeleke R. A., Ogunwale O.D., & Halid O.Y. (2009), "Application of Queuing theory to Waiting Time of Out-Patients in Hospitals", The Pacific Journal of Science and Technology, Vol. 10, No.-2, November 2009.

Agrawal Gaurav; Saxena, Gaurav; (2010), "Queuing Model for health care centre"[http://74.125.155.132/scholar?q=cache:QsEUUMSV3AQJ:scholar.google.com/&hl=en&as\\_sdt=2000](http://74.125.155.132/scholar?q=cache:QsEUUMSV3AQJ:scholar.google.com/&hl=en&as_sdt=2000).

Biggs Amanda, "Hospital waiting lists explained", Social Policy Section, Online only 14 March 2008.

Creemers S., Lamberecht (2007), "Queueing Models in Healthcare" [www.econ.kuleuven.be/tem/jaargangen/.../TEM\\_07-3-09\\_Creemers.pdf](http://www.econ.kuleuven.be/tem/jaargangen/.../TEM_07-3-09_Creemers.pdf).

Dahl WJ., Haskey N. 2006. Synbiotic therapy: A promising new adjunctive therapy for ulcerative colitis. Nutrition Reviews, 64(3), 132-138.

Fomundam Samuel, Herrmann Jeffery (2007), "A Survey of Queuing theory Applications in Healthcare" [drum.lib.umd.edu/bitstream/1903/7222/1/tr\\_200724.pdf](http://drum.lib.umd.edu/bitstream/1903/7222/1/tr_200724.pdf).

Mehandiratta Reetu, (2011), "Application of Queuing theory in Health Care", International Journal of Computing and Business Research, ISSN (online): 22296166, Vol. 2 Issue 2 May 2011.

Schoenmeyr Tor, Dunn Peter F, Gamarnik David, Levi Retsef, Berger David L., Daily Bethany J., Levine Wilton C., Sandberg Warren S., "A Model for Understanding the Impacts of Demand and Capacity on Waiting Time to Enter a Congested Recovery Room", Anesthesiology, V 110, No 6, Jun 2009.