

# Hospital Queue Management System for Patient Admission and Bed Availability

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## Abstract:

These haphazard waits, overcrowding, and inefficient use of available resources also affect patient care at hospitals. This paper introduces a sort of HQMS system emphasizing the optimization in the admissions process and usage of beds while keeping priority on the patients according to their condition criticality and providing immediate wait-time estimation that would reduce anxiety from the waiting patients. It also offers an advanced bed management feature which tracks the availability and optimizes the room assignment to avoid overcrowding. HQMS also streamlines the discharge process so that bed turns are faster with smooth patient flow. In short, the system integrates all of these features to improve patient care and minimize waiting hours and overall hospital inefficiency.

## Introduction

The role that effective management of patient systems plays in optimizing the workings of a hospital and the health experience of the patient in a healthcare system now is enormous. A Hospital Queue Management System for Patient Admission and Availability of a Bed will help in relieving overcrowding, bad resource allocation, and long waiting times, which are generally considered to be harmful to the two sides of operational efficiency as well as patient satisfaction. This system combines elements of patient registration, admission, and bed management under a very strong framework based on the prioritization of patients according to the urgency of their medical needs. The system also provides real-

time estimates of wait times and sends timely notifications to the patients and staff to improve communication and service delivery. Further, data analytics suggests a system allows the hospital to monitor its effectiveness and keep track of crucial metrics for it to make appropriate decisions for continuous improvement. It is within this context that such systems-with adherence to privacy and security standards-create a more streamlined and responsive environment for not only hospital efficiency but also the quality of patient care. This paper discusses the architecture and functionalities of such a system with an extensive analysis of how such systems can transform management processes among patients and hospital operations.

## Background

Since many traditional methods of hospital patient admission often depend on manual processes, there is a high propensity towards human error and an inordinate time consumption, hence inefficiency in the operations of a hospital. With the advent of healthcare information systems comes automation, which has become a prime means to improve administrative efficiency, specially through the medium of electronic queue management systems. Huge improvements in service delivery have been elicited through various researches attributing to these systems, especially to busy facilities like EDs (Health Affairs, 2021; Journal of Hospital Administration, 2021). The queue must, therefore be properly managed.



## Methodology

1. A proper and sound system design for the registration and admissions system
2. Enhance capability of bed management through optimal use of hospital resources
3. Real-time prioritization of patients with accurate wait-time estimates.
4. Improve Overall Patient Communication Along the Care Journey.

## Proposed Methodology

The research uses mixed-methods to find out how innovative methodologies impact on patient registration and the management of queues in hospitals. Surveys of the hospitals with hospital staff form the data to pinpoint the challenges and needs there are currently, as well as a review of the existing literature for queue management systems. This qualitative analysis lays some basic understanding of operational bottlenecks, while the quantitative emphasis lies on evaluation of the performance of the system. It expands on how technology is more integrated within the workflow of the hospital, like speedy digital systems that augment rapid access to data and minimal human mistake, allowing for less waiting time and better resource utilization. The Lean philosophy has also been embraced by many hospitals to enhance the operations in most the busy departments in the OPD with the objective of ridding it from crowding and enhancing patient flow.

## System Architecture

The HQMS is designed using a multi-tier architecture with various modules and different functions to each of the following modules:

1. **User Interface:-** Layer An interface towards patient and staff interactions.
2. **Application Layer:-** Manages the business logic; takes care of the patients' information processing, flow of queues, and information regarding the bank accounts.
3. **Data Management Layer:-** Manages the interaction with databases; secures the storage of the patient's information and performs analytics.



## Bed Management

The management of available hospital beds is crucial in ensuring care access is timely and in an efficient manner, particularly during peak periods, when patient inflow into hospitals presents a challenge that requires careful balancing with available resources. Administrators can explore scenarios and their impacts on key performance metrics-including wait times and length of stay-for scenarios using discrete-event simulation models of hospitals. This methodology would highlight critical points during care delivery, thereby ensuring that appropriate strategies could be implemented to ease strain on the overly burdened departments. Indeed, a defined capacity planning methodology indeed assists in better decision-making by providing an unclear vision of operational dynamics towards better and judicious resource utilization and policy change.

In this case, optimal utilization of hospital functions is served through a sound bed management system. High technology, such as real-time RFID and electronic health records, enable tracking of the ever-changing bed availability. This can therefore assign available beds in real time and promptly to incoming patients, thus improving bed utilization as well as patient flow, which helps in better quality of care and lower operational costs. Advanced simulation and technology-driven bed management increases the efficiency of the system, reduces bottlenecks, and improves patient care.

## Wait time Estimation

Real-time wait time estimation through predictive analytics gives patients accurate information regarding the expected wait times, thus improving the experience of the patient and anxiety during hospital visits

## Patient Notification

The HQMS contains a notification system that keeps the patients informed of their status from the admission up to the end of the admission cycle. This enhances communication with the patient and keeps the patient updated.

## Discharge Workflow

The management system contains the workflow of discharges in it, by its integration, it processes the discharge lines in an automatic manner, as it sends a real-time notification of bed availability to the clinical team

## Performance Analytics

The HQMS will be measured based on key performance metrics-the patient wait times, admission-to-bed assignment times, discharge efficiency, and overall patient satisfaction rates.

## Security & Privacy

There is a requirement for the patient's data privacy and security. HQMS has encryption protocols, access controls, and healthcare regulations such as HIPAA compliance to protect sensitive information.

## Scalability

The HQMS is designed to scale up when incorporating additional modules and integrations that fit the needs of hospitals over time. This assures the health facility of enduring quality and improvement of management practice of patients.

## **Patient Registration & Admission**

### **Process**

An efficient patient registration process is crucial for the effectiveness of the Hospital Queue Management System (HQMS) and significantly enhances overall hospital operations. By facilitating online registration and pre-admission procedures, the system effectively alleviates bottlenecks at the hospital entrance, speeding up the admission process. To further boost efficiency, the system includes pre-check-in notifications and an automated triage mechanism that evaluates patient needs upon arrival. The incorporation of machine learning algorithms within the system also contributes to this efficiency.

### **Conclusion**

That is, efficient queue management and bed management in hospitals essentially contribute to patient satisfaction through effective and timely care with optimized resource use in the health sectors. Further, the application of DES in modeling the flow of patients and the operation of hospitals gives more insight into bottlenecks that afford inefficiencies, leading to optimized resource allocations, reduced waiting times, and improved patient outcomes. For example, using DES to analyze patient flow within Accident & Emergency departments can guide the hospitals about better management in terms of manpower and bed assignments to enhance the delivery of patient care.

These hospital queue management systems are necessary to be reviewed and developed continuously by the growing healthcare demands. Continuous changes demand new technologies, data analytics, and patient-centered strategies for maintaining operational efficiency and sustaining quality care. Conclusion: DES implementation in hospital workflow management not only enhances the

operational performance but ensures that the patient is at the center of it all; one all-conquering principle which not only favors the patients but the care providers as well.

### **Future Enhancement**

Future advancements in Hospital Queue Management Systems would make healthcare significantly more efficient. Applications of AI and ML integrated into HQMS will actually optimize the flow of patients, predict admission rates, and even dynamic resource adjustment in real-time to minimize waiting time and better patient care. Real-time data analytics will provide immediate opportunities to adjust bed availability and offer wait-time tracking and status updates through mobile apps for patients, further improving the transparency of the care process, reducing anxiety. Moreover, any integration of telemedicine into the triaging processes makes it more streamlined to deal with the patient intake.

However, it will still be dangerous to the employees for operational resistance, complicated system integration, and long-term training. This will require a good change management plan to effect its implementation. Finally, information safeguarding security will be quite in need as patient privacy is taken into considerations when these technologies are implemented in the hospitals.

Thus, a transition of AI, mobile apps, and telemedicine in the HQMS would result in more effective operations along with increased customer satisfaction, thereby transforming healthcare delivery and making it more responsive and patient-centred.

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