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ER Wait Time Report

by

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1.Introduction

Emergency departments (ERs) play a critical role in delivering timely medical care, especially during high-demand periods. However, long wait times continue to be one of the major challenges affecting patient experience, staff workload, and overall hospital efficiency.

This report analyzes ER wait times using multiple factors such as time of day, urgency level, nurse-to-patient ratio, and seasonal patterns. Through visualizations and statistical insights, the goal is to identify bottlenecks and propose practical recommendations that improve patient flow, reduce delays, and enhance patient satisfaction.

2.Dataset Description

The dataset contains detailed visit-level information for emergency room patients, including:

- Visit ID and Patient ID
- Hospital name and region
- Visit date, day of week, and season
- Time of day (Early Morning, Late Morning, Afternoon, Evening, Night)
- Urgency level (Critical, High, Medium, Low)
- Nurse-to-patient ratio
- Time intervals: registration, triage, and time to see a medical professional
- Total wait time (in minutes and hours)
- Patient satisfaction score

The dataset was cleaned by removing missing values, converting time fields into numeric formats, and calculating final indicators such as total wait hours.

3.Methodology

The analysis was conducted using:

- **Python libraries**: Pandas, NumPy, Seaborn, Matplotlib
- **Visualization tools**: Matplotlib & Seaborn
- **Dashboard framework**: Streamlit

Steps followed:

1. Data loading and cleaning
2. Feature engineering (hour extraction, total wait calculation)
3. Exploratory Data Analysis (EDA)
4. Visualization of patterns and trends

5. Interpretation and recommendations

4.Analysis & Visualizations

4.1 Average ER Wait Time by Hour and Day of Week

This heatmap shows that wait times peak during the **Evening**, especially on **Monday**, **Thursday**, and **Friday**.
This indicates staffing shortages during peak hours.

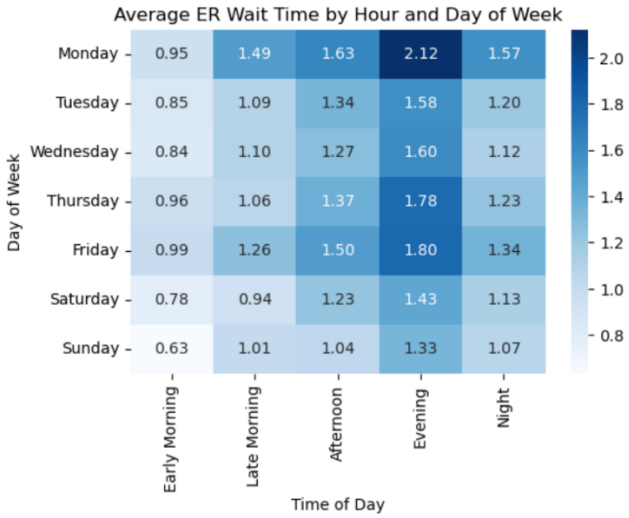

Figure 1.Data visulization using heatmap

Recommendations:

- Adjust staff schedules to match patient volume peaks.
- Increase triage team speed and capacity during late morning and evening peaks.
- Implement a fast-track pathway for low- to medium-severity cases

4.2 Average ER Wait Time by Severity Level

Higher urgency levels (Critical, High) naturally receive faster care.
However, **Low urgency cases have the longest wait time**, exceeding 2.8 hours.

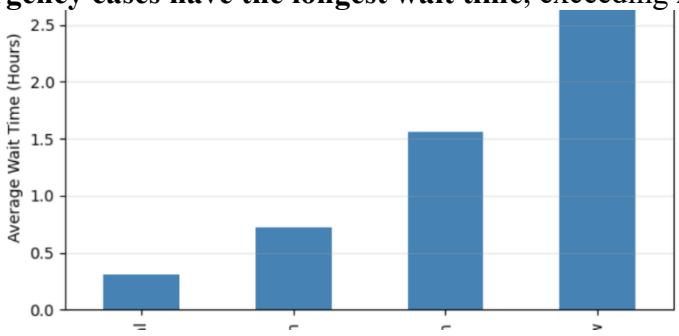

Figure 2.Average ER Wait Time by Severity Level

Recommendation:

- Implement a dedicated **fast-track clinic** to handle simple and moderate cases efficiently.

4.3 Average ER Wait Time by Nurse-to-Patient

As the nurse-to-patient ratio increases (meaning fewer nurses per patient group), wait times rise significantly.
Ratios of **1:4** and **1:5** show the highest delays.

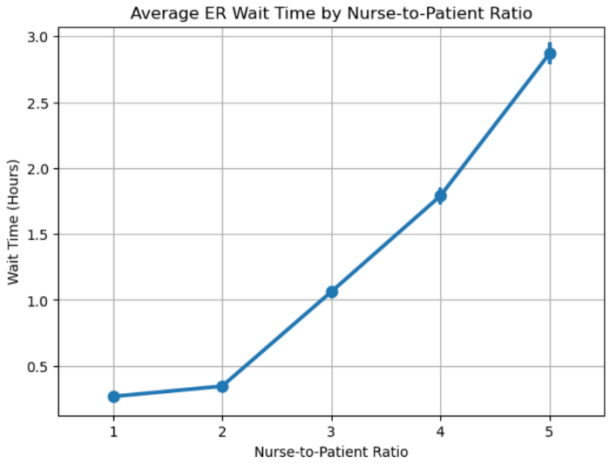

Figure 3.Average ER Wait Time by Nurse-to-Patient

Recommendations:

- Increase nursing staff during peak hours.
- Adopt flexible staffing models based on hourly demand.
- Reinforce triage staffing to minimize initial assessment delays.

4.4 Average ER Wait Time Across Seasons

Winter shows the **highest wait time**, followed by Summer, while Fall has the shortest.

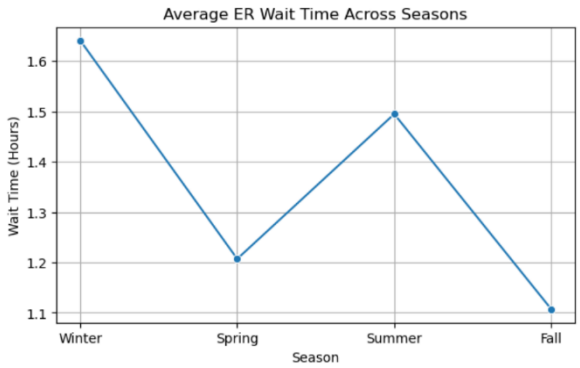

Figure 4. Average ER Wait Time Across Seasons

Recommendation:

- Launch seasonal health campaigns (e.g., flu vaccines, respiratory illness prevention) to reduce ER load during winter and summer peaks.

4.5 Patient Satisfaction vs Time to See Medical Professional

There is a strong **negative correlation** between wait time and satisfaction.
The longer a patient waits, the lower the satisfaction score becomes.

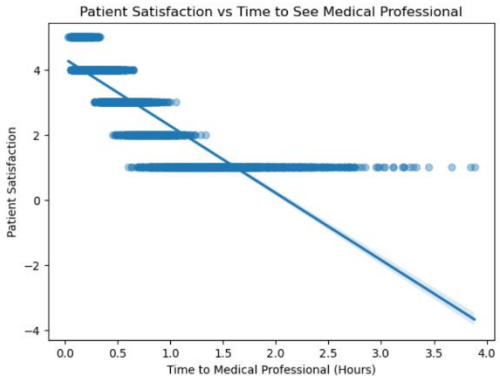

Figure 5.Patient Satisfaction vs Waiting Time

Recommendations:

- Reduce time to see a physician by optimizing triage and shifting staff.
- Expand fast-track pathways to avoid long delays for simple cases.

5.Overall Recommendations

- Reallocate staff based on real-time demand data.
- Strengthen triage staffing between **11 AM (late morning)** and **evening peak**.
- Implement a **fast-track area** for simple and moderate cases in all hospitals.
- Increase nurse staffing during high-demand hours.
- Launch seasonal awareness programs during winter and summer.
- Improve patient flow to reduce time to see a medical professional.

6.Conclusion

This analysis highlights significant patterns influencing ER wait times such as peak hours, urgency levels, seasonal trends, and staff ratios.
Findings show that long wait times negatively impact patient satisfaction and overall service quality.
By adopting the recommended strategies particularly staff reallocation, enhanced triage processes, and fast-track services hospitals can substantially reduce wait times, improve efficiency, and enhance patient trust and experience.

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