PATIENT FLOW OPTIMIZATION DASHBOARD FOR URBAN HOSPITAL NETWORK

Background and Objective:

A large urban hospital network with three branches experienced significant challenges in tracking emergency room overcrowding, ICU occupancy, and general bed availability. Traditional reporting through spreadsheets caused delays and mismanagement in critical situations.

Objective: To develop an interactive Tableau dashboard that enables real-time monitoring of patient inflow, bed occupancy, waiting time, and resource distribution, thereby improving hospital operations and patient experience.

Methodology:

1. **KPI Definition:**
    - Bed Occupancy Rate (BOR)
    - Average Patient Waiting Time in ER
    - ICU Bed Utilization %
    - Daily Admissions and Discharges
    - Inter-department Transfer Delays
2. **Data Integration & Cleaning:**
    - Merged electronic health record (EHR) exports with scheduling logs
    - Applied time-based filters to calculate daily/hourly metrics
    - Resolved timestamp inconsistencies between systems
3. **Dashboard Layout Strategy:**
    - Tabs: ER Flow, ICU Dashboard, General Ward View, Resource Summary
    - Filters: Date, Hospital Branch, Department, Age Group, Severity Code
    - Visuals:
        - Area chart for ER visits vs discharges per hour
        - Bullet chart for ICU capacity thresholds

- Gantt chart for patient transfer timeline
- Heat map of ward-wise bed utilization

Data Sources:

- EHR data dump (JSON converted to CSV)
- Departmental bed availability logs (Excel)
- Staff shift rosters (CSV)
- Triage categorization and severity codes (internal classification)

Tools and Technologies:

- **Tableau Desktop** – primary visualization platform
- **Tableau Prep** – data cleaning, shaping, and joins
- **Python (Pandas)** – used for pre-aggregation of time-based data
- **Microsoft Excel** – initial data audit and merging

Results and Interpretations:

- **ER Overload Identified at Specific Time Windows:** Spike in ER traffic between 6 PM – 10 PM with longest wait times observed in the east branch.
- **ICU Resource Bottlenecks Detected:** ICU occupancy stayed above 95% for 21 out of 30 days, requiring policy review on elective surgery scheduling.
- **Transfer Delays Made Visible:** Median transfer time from ER to ward exceeded 90 minutes on weekends due to reduced administrative staff.
- **Resource Reallocation Initiated:** Based on dashboard insights, one branch shifted a portion of night duty staff to cover peak ER load hours, reducing wait times by 22%.

Conclusion:

The Tableau dashboard provided an actionable overview of patient flow and hospital resource use. Real-time visual insights helped hospital administrators prioritize bottlenecks, optimize staffing, and adjust resource allocation in critical departments.

Future Work:

- **Predictive Layer:** Add machine learning model to predict peak ER load hours using past trends.
- **Automated Alerts:** Set up threshold-based notifications for ICU overcapacity or abnormal wait times.
- **Patient Satisfaction Data:** Integrate post-discharge survey results to correlate delays with patient feedback.
- **Cross-Department Drill-Down:** Build capability to drill into individual patient flow per department.

Suitability:

- **Academic:** Suitable for healthcare management, public health informatics, and data visualization coursework.
- **Corporate:** Relevant for hospital operations teams, public health administrators, and healthtech analytics providers.