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Subject: Data Visualization

Hospital Performance Analysis Report

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Introduction:

This report provides an in-depth evaluation of hospital operational performance using real-world healthcare data collected between **July 2024 and June 2025**. The analysis covers several key dimensions of hospital operations, including appointment flow, admission trends, departmental efficiency, staff workload distribution, and revenue generation across the hospital's major service lines.

The dataset includes **1,000 patient appointments**, **1,000 hospital admissions**, **2,000 patients**, **400 doctors**, **500 nurses**, and **677 support staff** distributed across **10 primary departments**. The hospital operates with **179 rooms** and **442 beds**, achieving a total annual revenue of **109.8M $** from clinical and non-clinical services.

Business Problem:

Healthcare organizations continuously face the challenge of balancing operational efficiency with high-quality patient care. This analysis addresses several critical issues:

- **Appointment Efficiency:** With a **10.2% no-show rate** and **4.3% cancellation rate**, the hospital loses nearly **14.5%** of scheduled appointments, affecting both revenue and resource utilization.
- **Resource Allocation:** Evaluating whether the current distribution of medical and support staff aligns with actual patient demand and whether room and bed occupancy rates are optimized.
- **Revenue Optimization:** Identifying the most profitable departments and services, and uncovering opportunities to enhance financial performance.
- **Patient Experience:** Analyzing patient demographics, diagnosis patterns, and length of stay to improve care delivery and operational planning.
- **Departmental Performance:** Identifying high-performing departments and those requiring improvement in terms of efficiency and resource management.

Objectives:

This dashboard and report are designed to achieve the following goals:

- **Deliver actionable insights** that enable hospital administrators to make informed, data-driven decisions.
- **Identify operational bottlenecks and inefficiencies** across appointments, admissions, departments, and staff utilization.

- **Recommend evidence-based improvements** to enhance patient outcomes, service quality, and overall financial performance.
- **Support strategic planning** by providing a clearer understanding of resource allocation, capacity management, and future operational needs.

Story Explanation: "Optimizing Hospital Operations Through Data-Driven Insights"

The Main Story:

The analysis highlights a hospital functioning at a solid operational capacity, yet with considerable room for improvement. Although the facility manages a high patient volume and generates **1.66M $ from appointments alone**, several critical challenges continue to impact its overall efficiency and financial health.

The Central Challenge:

The most pressing issue is the **14.5% loss in scheduled appointments** (missed + cancelled), resulting in an estimated **240K $ in annual revenue losses** from appointments alone. Furthermore, the uneven distribution of patient demand across departments—combined with an average length of stay of **5 days**—suggests opportunities to rebalance workloads, enhance resource allocation, and increase patient throughput.

The Journey Through the Data

- Appointments Page:
  Displays strong performance with a 76.9% completion rate, while also uncovering concerns related to missed and cancelled appointments.
- Admissions & Departments Page:
  Shows that Critical Care and Surgery lead in both admissions and revenue generation, whereas other departments appear comparatively underutilized.
- Patient Analysis Page:
  Highlights a diverse patient population with notable trends in demographics, diagnoses, and service utilization.
- Staff & Workload Page:
  Reveals potential imbalances in workload distribution, with some doctors managing significantly more appointments than others.

Key Performance Indicators (KPIs)

- Appointment Completion Rate: 76.9%
- Cancellation Rate: 4.3%
- Missed Appointment Rate: 10.2%
- Average Length of Stay: 5 days
- Total Revenue: 109.8M $
- Bed Capacity: 442 beds available with 1,000 admissions
- Staff-to-Patient Ratio: 400 doctors and 500 nurses serving 2,000 patients

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Chart Descriptions & Insights

1. Appointments Dashboard:

A. KPI Cards (Top Row)

Charts:
Total Appointments (1,000) | Completion Rate (76.9%) | Cancellation Rate (4.3%) | Missed Rate (10.2%) | Revenue (1.66M $

Why These Charts Were Chosen:
The KPI cards offer a quick, high-level snapshot of the hospital's appointment performance, helping decision-makers instantly gauge the effectiveness of the scheduling system.

Insights Identified:

- The hospital handled approximately 1,000 appointments during the analysis period.
- While the 76.9% completion rate is reasonable, the combined 14.5% loss rate indicates substantial revenue leakage.
- Missed appointments (10.2%) occur more frequently than cancellations, suggesting that no-shows are a more critical issue than patient-initiated cancellations.
- Appointment revenue (1.66M $) accounts for only 1.5% of total hospital revenue, confirming that inpatient and department-based services are the primary financial contributors.

B. Total Appointments by Date (Line Chart)

Why This Chart Was Chosen:
A line chart effectively highlights trends, fluctuations, and potential seasonal patterns over time, making it easier to identify anomalies or operational bottlenecks.

Insights Identified:

- Monthly appointments fluctuate between 60–100, showing moderate variation throughout the year.
- December 2024 recorded the highest volume (100 appointments), potentially due to seasonal illnesses or end-of-year medical checks.
- Q2 2025 (April–June) displays a declining trend, which may indicate lower patient demand or issues in scheduling or outreach.
- No consistent seasonal pattern appears, suggesting overall stable appointment demand across the year.
- The hospital appears capable of handling 80–90 appointments per month efficiently.

C. Appointments by Appointment Mode (Pie Chart)

Why This Chart Was Chosen:
Pie charts convey the proportional distribution of categorical data clearly, especially when there are only a few categories.

Insights Identified:

- Appointment modes are evenly distributed:
  - Online: 31.3%
  - In Person: 34.5%
  - Call: 34.2%
- This balance indicates that all access channels are actively used and valued by patients.
- The slightly higher In-Person bookings suggest some patients prefer direct interaction, possibly for trust, convenience, or staff support.
- A strong online presence (31.3%) highlights successful adoption of digital services.

Recommendation:
Maintain all three booking channels but consider enhancing the online booking system to shift more load away from phone and in-person registrations, reducing staff pressure and improving efficiency.

D. Appointment Revenue by Payment Mode (Bar Chart)

Why This Chart Was Chosen:
A horizontal bar chart makes it easy to compare payment categories, especially when category labels are long or numerous.

Insights Identified:

- Digital Wallets contribute the highest appointment revenue (438.46K $ — 26.4%), demonstrating strong adoption of digital financial tools.
- Insurance payments follow closely (413.69K $ — 24.9%), indicating a significant insured patient base.
- Cash (408.58K $) and Card (402.62K $) show nearly identical contributions (~24.5% each), reflecting balanced payment preferences.
- The even distribution across payment modes shows excellent payment flexibility and accessibility.
- High digital wallet usage suggests a tech-aware and digitally comfortable patient population.

Recommendation:
Encourage digital payment methods (wallets and cards) through incentives or streamlined processes to reduce cash-handling overhead and enhance transaction efficiency.

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2. Admissions & Departments Dashboard:

A. KPI Cards (Top Row)

Charts:
Total Admissions (1,000) | Total Rooms (179) | Total Beds (442) | Avg. Stay (5 days) | Inpatient Revenue (108.12M $)

Why These KPIs Were Chosen:
They highlight the hospital's operational capacity and financial performance, helping administrators evaluate inpatient demand and resource utilization.

Insights Identified:

- The hospital recorded 1,000 admissions during the analysis period.
- With 442 beds serving 1,000 annual admissions, the bed occupancy level appears healthy, though it varies by department.

- The average length of stay (5 days) falls within standard ranges but differs significantly depending on diagnosis and unit.
- Inpatient services contribute 108.12M $, representing 98.5% of total revenue, confirming that the hospital is predominantly inpatient-focused.
- The 179 rooms to 442 beds ratio (≈ 2.47 beds per room) indicates a mix of private, semi-private, and shared accommodations.

B. Room Type Distribution (Pie Chart)

Why This Chart Was Chosen:
It visually communicates the hospital's accommodation structure and helps assess its alignment with different patient segments and pricing tiers.

Insights Identified:

- Room types are almost evenly distributed:
  - Standard: 347 rooms (34.7%)
  - Super Deluxe: 331 rooms (33.1%)
  - Deluxe: 322 rooms (32.2%)
- This balanced setup allows the hospital to cater to diverse financial segments.
- The near-equal distribution reflects a strategic mix that appeals to both cost-sensitive and premium patients.
- Revenue implication: Higher-tier rooms (Deluxe & Super Deluxe) likely carry larger profit margins—optimizing their occupancy could generate higher revenue.

C. Rooms, Beds, and Appointments Revenue (Stacked Bar Chart)

Why This Chart Was Chosen:
The stacked bar chart provides a clear comparison of major revenue streams and highlights the financial weight of each service line.

Insights Identified:

- Total Revenue: 109.8M $, broken down as:
  - Rooms Revenue: 72.1M $ (65.7%)
  - Beds Revenue: 36.1M $ (32.9%)
  - Appointments Revenue: 1.7M $ (1.5%)

- The dominance of room and bed revenue shows that the hospital's business model is primarily inpatient-driven.
- The minimal share from appointments suggests:
    - Low consultation fees, or
    - Appointments serve mainly as an entry point to higher-value inpatient services.

Strategic Implication:
To maximize financial impact, operational optimization should focus primarily on inpatient workflows, bed management, and room occupancy.

D. Top 5 Departments by Room Type & Revenue (Combo Chart)

Why This Chart Was Chosen:
The combination of bars and lines enables simultaneous comparison of departmental volume and financial performance.

Insights Identified:

- Critical Care leads with ~14M $ in revenue and the highest room utilization.
- Surgery follows with ~9M $, reflecting strong demand for surgical procedures.
- General Medicine and Emergency Medicine generate moderate revenue (~8–9M $).
- Cardiology completes the top five at ~8M $.
- The sharp revenue drop from Critical Care to other departments highlights a heavy dependence on high-acuity services.

Concern:
The top five departments likely contribute 60–70% of total revenue, indicating a concentration risk if demand shifts in any of these key areas.

E. Admissions by Length of Stay (Combo Chart)

Why This Chart Was Chosen:
Length-of-stay analysis is essential for evaluating patient flow, bed turnover, and operational efficiency.
Insights Identified:

- A large portion of admissions (668 cases) show 0-day stays, which could indicate:
    - Emergency visits
    - Outpatient procedures counted as admissions

    - Same-day discharge workflows
    - Potential data recording inconsistencies
- Revenue declines consistently as length of stay increases, reflecting lower patient volume in longer-stay categories.
- 5-day stays stand out, generating 58M $ from 227 admissions—a key revenue sweet spot.
- Long-stay patients (20+ days) are few but contribute high revenue per patient.
- The overall average of 5 days is skewed downward due to the large number of 0-day stays.

Recommendation:
Investigate the classification of 0-day admissions and optimize processes for 5–10 day stays, which yield the highest financial impact with manageable resource usage.

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3. Patients Analysis Dashboard

A. KPI Cards (Top Row)

Charts:
Total Visits (3,000) | Total Patients (2,000) | Average Age (49) | Average Stay (5 days)

Why These KPIs Were Chosen:
They summarize patient demographics and utilization patterns, offering a quick understanding of who the hospital serves and how frequently they seek care.

Insights Identified:

- The hospital recorded 3,000 visits from 2,000 patients, averaging 1.5 visits per patient, indicating moderate repeat engagement.
- The average patient age of 49 suggests a primarily middle-aged to older adult population, typically requiring chronic disease and long-term care services.
- An average stay of 5 days is consistent with the admissions metrics and reflects stable inpatient utilization.

Strategic Implication:
The hospital should prioritize services commonly used by middle-aged and older adults such as **cardiology**, **diabetes management**, and **routine chronic care programs**.

B. Total Records by Date (Line Chart)

Why This Chart Was Chosen:
A line chart effectively highlights patient visit patterns over time, helping detect growth trends, seasonal behavior, or data inconsistencies.

Insights Identified:

- Visits increased sharply from 148 records in early 2024 to a peak of 1,273 in Q1 2025, indicating strong growth and demand.
- A steep decline appears in Q2 2025, dropping to 169 records, followed by very low volumes (60–68 records) in Q3–Q4.
- The extreme fluctuations suggest:
- Possible data collection gaps rather than real patient behavior
- Incomplete 2025 data (if the report was generated mid-year)
- Less likely: true seasonal variations

Concern:

The sharp decline requires further investigation to confirm whether it reflects **data quality issues** or **loss of patient volume**.

C. Patients by Gender (Pie Chart)

Why This Chart Was Chosen:
Pie charts effectively visualize gender distribution, a key factor in planning gender-specific services.

Insights Identified:

- **Male:** 790 patients (52.67%)
- **Female:** 710 patients (47.33%)
- The distribution is nearly equal, with a slight male majority (about 5%).
- This indicates the hospital serves both genders **almost equally**, with no significant skew.

Service Planning Implication:
Gender-specific clinics and resources should be **balanced**, as both groups are similarly represented.

D. Top 5 Diagnoses (Bar Chart)

Why This Chart Was Chosen:
Horizontal bar charts allow easy comparison of diagnosis frequencies and highlight dominant health conditions.

Insights Identified:

- General Checkup is overwhelmingly the most common reason for visits (1,799 cases), more than 13 times any other diagnosis.
- Other top diagnoses reflect common chronic conditions:
- Essential Hypertension: 137 cases
- Migraine Headache: 137 cases
- Angina Pectoris: 129 cases
- Bronchial Asthma: 122 cases
- The large dominance of “General Checkup” suggests:
- Strong preventive care utilization
- Possible overuse of a catch-all label instead of precise diagnostic coding

Strategic Implication:
Develop targeted care pathways for **hypertension**, **cardiac conditions**, and **respiratory diseases**, which align with the demographic profile.

E. Patients by Age Group (Bar Chart)

Why This Chart Was Chosen:
Age segmentation helps identify the hospital’s primary patient base and supports decisions on service-line development.

Insights Identified:

- **60+** group is the largest segment with **592 patients (39.5%)**.
- **Under 18:** 268 patients (17.9%), indicating a notable pediatric base.
- Adults:
  - **45–59:** 233 patients (15.5%)
  - **30–44:** 226 patients (15.1%)
  - **18–29:** 181 patients (12.1%) — the smallest adult group

- Over **55% of patients are 45+**, confirming that the hospital primarily serves an **older adult population**.
- The strong pediatric group reflects family-centered care demand.

Strategic Implication:
Strengthen:

- Geriatric care
- Chronic disease management programs
- Pediatric services

While maintaining general care capacity for younger adults.

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4. Staff & Workload Dashboard

1. KPI Cards (Top Row)

Charts:
Total Doctors (400) | Total Nurses (500) | Total Helpers (677)

Why chosen:
These workforce metrics are essential for understanding staffing levels and planning HR needs.

Insights revealed:

- Total staff: 1,577 employees (400 doctors + 500 nurses + 677 helpers)
- Nurse-to-Doctor ratio: 1.25:1 - relatively balanced professional staff
- Support staff (helpers) outnumber clinical staff, comprising 43% of total workforce
- With 2,000 patients, the ratios are:
    - 1 doctor per 5 patients
    - 1 nurse per 4 patients
    - These ratios appear healthy for quality care delivery
- Concern: The high number of support staff may indicate operational inefficiencies or may be necessary for the facility size

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2. Total Doctors & Nurses by Department (Combo Chart)

Why chosen:
This chart reveals staff distribution across departments and helps identify potential staffing imbalances.

Insights revealed:

- Critical Care has the most staff (approximately 113 total) and highest admissions - good alignment
- Staff distribution generally follows admission volume, showing logical resource allocation
- Some departments show concerning patterns:
    - Homeopathy has very few staff but still operates
    - ENT and Rehabilitation appear understaffed relative to other departments
- The blue line (likely admissions) shows closer correlation with staffing in larger departments
- Strategic concern: Smaller departments may face workload challenges with limited staff

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3. Total Doctors by Department_Name (Bar Chart)

Why chosen:
Shows physician distribution to assess whether doctor allocation matches department needs.

Insights revealed:

- General Medicine leads with 52 doctors
- Critical Care (51) and Emergency Medicine (47) follow closely
- Uneven distribution: Top 3 departments have 150 doctors (37.5% of total), while bottom 4 have only 40 doctors combined
- Surgery (38 doctors) seems potentially understaffed given its revenue importance
- Specialties like Gynecology, Geriatrics, Pediatrics are underserved with only 8-10 doctors each
- Concern: Some high-revenue departments (Surgery, Cardiology) may need more physicians

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4. Total Appointments by Doctors (Bar Chart)

Why chosen:
Critical for identifying workload imbalances and potential burnout risks among physicians.

Insights revealed:

- Extreme workload disparity: Dr. Raza Hasnain handles 505 appointments while Dr. Hanif Kamal handles only 29
- Top 3 doctors (Raza Hasnain, Waqas Javed, Muhammad I.) manage 722 appointments (72.2% of total 1,000)
- This massive concentration indicates:
    - Potential burnout risk for top doctors
    - Underutilization of many physicians
    - Possible data quality issues if these are aggregated records
    - Patient preference patterns - some doctors may be highly sought after
- 17.4x difference between highest and lowest workload is concerning
- Critical recommendation: Urgent need for workload redistribution and capacity balancing

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Key Findings & Recommendations

- **Critical Issues (5 Issues):**

#	Issue	Simplified Explanation
1	Lost Appointments	14.5% of patients missed or cancelled = 240K $ revenue loss
2	Doctor Workload Imbalance	Dr. Raza has 505 appointments, another doctor has only 29
3	Revenue Concentration	Most revenue comes from Critical Care and Surgery – high financial risk
4	0-Day Admissions	668 patients admitted and discharged on the same day – unclear data
5	Decline in 2025 Patient Volume	Possible registration issue or patients went elsewhere

- **Positive Findings (4 Good Points):**

#	Positive Finding	Simplified Explanation
1	Balanced Booking Methods	Online, phone, and in-person bookings are nearly equal
2	High Digital Payment Adoption	26% via digital wallets = lower cost and faster transactions
3	Adequate Staffing	1 doctor per 5 patients – healthy ratios
4	Services Aligned with Patient Demographics	55% of patients are older adults, hospital has cardiology & chronic care – suitable

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Recommendations

Priority 1: Urgent – Reduce Lost Appointments

- **Issue:** 10.2% no-shows = 240K $ lost
- **Solution (3 steps):**
  - SMS reminders: 2 days and 1 day before the appointment
  - Small penalty: 25% of consultation fee if patient misses
  - Confirmation: Patient confirms 24 hours before
- **Expected Result:** Save ~130K $/year

Priority 2: Urgent – Balance Doctor Workload

- **Issue:** One doctor overloaded (505 appointments)
- **Solution (3 steps):**
  1. Automated appointment distribution across doctors
  2. Investigate cause: patient preference or system issue
  3. Tiered system: senior doctors handle complex cases, juniors handle routine
- **Expected Result:** Dr. Raza's appointments reduce from 505 → 300, others more utilized

Priority 3: Important – Open New Service Lines

- **Issue:** Revenue concentrated in 2 departments
- **Solution (3 steps):**
  1. Cardiology center: 266 cardiac patients = high potential
  2. Preventive care programs: convert 1,799 general checkups into monthly follow-ups
  3. Geriatric care: 592 patients aged 60+ = market opportunity
- **Expected Result:** 5–10M $ additional annual revenue

Priority 4: Important – Optimize Room Usage

- **Issue:** Increase room revenue (currently 72M $)
- **Solution:**
    1. Flexible pricing: higher during peak, lower in off-peak
    2. Reduce average stay by 1 day = 10% extra capacity
    3. Clarify 668 patients with 0-day stays
- **Expected Result:** 10–15M $ additional revenue

Priority 5: Enhance Technology

- **Solution:**
    1. Patient mobile app
    2. Improve online booking system
    3. Encourage digital payments
- **Expected Result:** Reduce staff workload + increase patient satisfaction

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