FINAL PROJECT REPORT

Hospital Resource Utilization & Patient Outcomes Dashboard

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1. Introduction

Healthcare organizations require timely, interpretable, and actionable insights to manage resources effectively while maintaining high standards of patient care. In multi-branch hospital networks, decision-makers must continuously monitor patient flow, staffing utilization, emergency demand, and treatment outcomes to support both operational efficiency and long-term capacity planning.

This project was developed as part of the **Career Carnival Hackathon (Business Analyst)** and focuses on designing an interactive analytics solution to support hospital operations and leadership teams. The solution enables stakeholders to analyze hospital performance across departments and branches using standardized metrics and intuitive visualizations.

The dashboard is built using **synthetic and anonymized data** to simulate real-world hospital operations in a mid-sized multi-specialty hospital network in India.

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2. Problem Statement

Hospital administrators and operations teams face challenges such as:

- Limited visibility into patient admissions and discharge efficiency
- Difficulty identifying operational bottlenecks across departments
- Managing emergency versus scheduled patient load
- Balancing doctor utilization and staffing capacity
- Monitoring patient outcomes, readmissions, and treatment costs
- Comparing performance across multiple hospital branches

The objective of this project is to design a **decision-support dashboard** that provides visibility into these areas and supports:

- Short-term operational decision-making
- Medium-term staffing and capacity adjustments
- Long-term strategic planning across hospital branches

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3. Objectives of the Solution

The primary objectives of the dashboard are:

1. To provide an executive-level overview of hospital performance
2. To identify operational bottlenecks related to emergency load and length of stay
3. To analyze resource utilization and patient outcomes across departments

4. To compare financial efficiency and demand trends across hospital branches
5. To ensure insights are interpretable by non-technical administrative staff

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4. Dataset Description

The analysis is based on a **synthetic hospital dataset**, designed to reflect realistic healthcare operations while ensuring privacy and ethical compliance.

Key Data Components

- Patient demographics (age group, gender, insurance type)
- Admission and discharge records
- Department and branch information
- Emergency vs scheduled admission flags
- Doctor utilization metrics (aggregated at department level)
- Billing and cost records
- Patient outcome records
- Readmission indicators (30-day)

Granularity

- Daily and monthly level aggregation

Note: The dataset is synthetic and anonymized. No real patient or hospital data is used.

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5. Tools & Technologies Used

- **Power BI Desktop** – Dashboard development and visualization
- **Microsoft Excel** – Synthetic dataset storage
- **Conceptual ETL Layer** – Designed using FastAPI (conceptual)
- **Database (Assumed)** – PostgreSQL (on-premise)

Due to Power BI Service tenant restrictions for personal accounts, the dashboard is demonstrated via a **public video walkthrough**, while deployment architecture is explained conceptually.

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6. Dashboard Architecture & Design Approach

The dashboard is structured into **three analytical layers**, each designed for a specific stakeholder group:

1. **Executive Overview** – High-level performance monitoring
2. **Operations & Bottleneck Analysis** – Department-level operational insights

3. **Planning & Branch Comparison** – Strategic and financial decision support

Consistent layout, standardized KPIs, and simple visualizations were used to minimize cognitive load and improve interpretability.

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7. Key Performance Indicators (KPIs)

The following KPIs are calculated dynamically using Power BI measures:

- Total Admissions
- Average Length of Stay (ALOS)
- Doctor Utilization (%)
- Emergency Case Share (%)
- Cost per Discharge
- 30-Day Readmission Rate

All KPIs respond to filters such as branch, department, and time period.

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8. Dashboard Pages & Insights

8.1

Page 1 – Executive Overview

Purpose:
To provide hospital leadership with a quick snapshot of overall performance.

Key Insights:

- Admissions show a gradual downward trend over time
- Average length of stay is improving, indicating better discharge efficiency
- Doctor utilization remains stable across departments
- Readmission levels are within acceptable ranges

Business Value:
This page enables executives to quickly assess whether hospital operations are improving or require intervention.

8.2

Page 2 – Operations & Bottleneck Analysis

Purpose:
To identify operational stress points and process inefficiencies.

Key Insights:

- Emergency cases contribute consistently across departments, indicating system-wide pressure rather than localized overload
- No single department consistently drives prolonged length of stay
- Operational processes appear standardized across departments

Business Value:
Operations teams can focus on process improvements rather than reactive staffing changes driven by perceived bottlenecks.

8.3

Page 3 – Planning & Branch Comparison

Purpose:
To support long-term planning, financial analysis, and branch-level comparison.

Key Insights:

- Cost per discharge varies across branches without significant differences in patient outcomes
- Readmission rates show slight variation across branches
- Admission trends highlight branches with increasing long-term demand

Business Value:
Leadership can identify opportunities for cost optimization and prioritize capacity planning for high-growth branches.

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9. Assumptions & Limitations

Assumptions

- Dataset accurately simulates hospital operations
- Doctor utilization is analyzed at department level, not individual level
- Bed occupancy is inferred using admissions and length of stay

Limitations

- Predictive insights are trend-based, not machine learning driven
- Real-world EMR and live data integration are not included
- Cost variations do not account for case complexity differences

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10. Conclusion

The Hospital Resource Utilization & Patient Outcomes Dashboard successfully demonstrates how data-driven insights can support hospital leadership in making informed operational and strategic decisions. By integrating admissions, resource utilization, patient outcomes, and financial metrics into a unified analytical view, the solution enables:

- Improved operational visibility
- Early identification of bottlenecks
- Evidence-based capacity planning
- Financial efficiency analysis

The dashboard is designed to be scalable and adaptable for real-world deployment with live data sources and automated ETL pipelines.

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11. Future Enhancements

- Integration with real-time hospital information systems
- Predictive modeling for bed occupancy and emergency surges
- Drill-down to individual doctor or ward-level utilization
- Automated monthly performance reporting

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12. Submission Notes

- Dataset used is synthetic and anonymized
- Dashboard interactivity is demonstrated via a public walkthrough video
- Repository includes dataset, Power BI file, and project documentation