

⚡ Upside-Down Healthcare System — Hospital Performance Analysis Project

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1. Project Overview

This project represents my second major healthcare analytics project, designed to evaluate hospital performance through key healthcare quality indicators (KPIs) — including **Readmission Rate, Average Length of Stay (LOS), and Mortality / Complication Rate**.

Unlike the previous “Perfect World” dataset, this one revealed a *different reality* — a healthcare system full of inconsistencies, outliers, and surprising patterns that mirror the real-world challenges of hospital management and care quality.

The project’s main goal was to identify which hospitals and departments underperform, analyze demographic disparities, and provide data-driven recommendations for improvement.

2. Data Source and Structure

The dataset used was the **Healthcare Analytics Dataset (Kaggle)**, containing synthetic but structured data on:

- **Admissions, Discharges, Readmissions**
- **Diagnoses and Procedures**
- **Departments** (e.g., Cardiology, Oncology)
- **Patient demographics** (Age, Gender, Insurance Type)

All patient identifiers were removed to ensure **data anonymization and ethical compliance**.

3. Tools and Environment

- **SQL (SQLite / DBEaver):** Data cleaning, transformations, and KPI calculations
- **Excel:** Validation, pivot summaries, and intermediate checks
- **Tableau (planned):** For visualizing hospital performance comparisons
- **Basic Statistics:** Descriptive summaries and rates

4. Analytical Framework

The analytical framework was designed to evaluate hospital efficiency, safety, and quality of care through a set of well-defined healthcare Key Performance Indicators (KPIs).

The main metrics included:

- **Readmission Rate:** Measures the percentage of patients readmitted within a certain time period after discharge. It reflects continuity and effectiveness of care — a higher value often indicates inadequate discharge planning or insufficient follow-up.
- **Complication Rate:** Calculates the proportion of patients who experienced medical complications during their hospital stay. This indicator serves as a direct measure of clinical safety and quality standards.
- **Success Rate:** Represents the share of hospitalizations completed without complications. It was calculated as the inverse of the complication rate, providing a clear success–failure perspective for each hospital and disease group.
- **Average Length of Stay (LOS):** Assesses the mean number of days patients remain hospitalized. While traditionally used to evaluate efficiency, in this project it helped to reveal whether longer stays correlated with better outcomes — an assumption that turned out to be false.

Each of these indicators was analyzed across multiple perspectives — including hospital, department, admission type (Emergency, Urgent, Elective), disease category (Asthma, Arthritis, Cancer, etc.), demographic group (age, gender), and insurance provider.

This framework allowed for a multidimensional understanding of performance gaps, helping to identify whether problems stem from medical processes, patient characteristics, or systemic inefficiencies.

The analysis also compared outcomes by:

- Admission Type (Emergency, Urgent, Elective)
- Disease Type (Asthma, Arthritis, Cancer, etc.)
- Age Group and Gender
- Insurance Provider

5. Key Findings

Hospital Performance

- **Worst hospitals:** PLC Thomas (66.67%), Ltd Brown (66.67%), Ltd Clark (63.64%)
- Indicates **systemic issues in safety and quality control**.

Disease Outcomes

- **Asthma** achieved the **best success rate (34.26%)** despite the **highest cost**.
- **Arthritis** showed the **lowest success rate (32.57%)**, suggesting inefficiencies in chronic-care management.
- **Cancer** cases had moderate success at lower costs.

Admission Type

- **Emergency** cases: 33.42% success
- **Urgent:** 33.21%
- **Elective:** 33.45%
→ Minimal differences, but **emergency protocols need reinforcement**.

Length of Stay (LOS)

- No strong correlation between LOS and outcome.
→ **Quality isn't about duration, it's about process consistency**.

Demographic Insights

- **Teens < 18 yrs:** lowest success (25–36%)
- **Elderly 65+:** relatively better outcomes
- **Female adolescents:** 25.45% success — **most vulnerable group**

Insurance Analysis

- **Blue Cross:** 33.83% success
- **UnitedHealthcare:** 33.33%
- **Medicare:** 33.11%
→ Costs are similar → **equity in pricing**, yet outcomes remain sub-optimal.

6. Strategic Insights & Recommendations

1. **Immediate audit** for PLC Thomas and Ltd Brown hospitals — possible temporary closure or intervention.
2. **Enhance emergency protocols** and staff training for critical cases.
3. **Targeted programs** for **adolescent care**, especially for teenage females.
4. **Review arthritis treatment pathways** to improve outcomes.
5. Establish a **continuous performance-monitoring dashboard** using Tableau.

7. Data Ethics and Compliance

- All patient data were **synthetic and anonymized**.
- No personal or identifying information was used.
- The analysis complies with **data privacy and ethical handling standards** (HIPAA-aligned principles for synthetic datasets).

8. Reflection

This project exposed the “upside-down” side of healthcare analytics — where numbers reveal chaos rather than perfection.

It was a powerful reminder that **clean data \neq clean systems**, and that the true skill of a data analyst lies not just in running queries, but in interpreting what the data *really say*.

9. Future Directions

- Develop a **Tableau Hospital Performance Dashboard** to visualize:
 - Complication rates by hospital
 - Outcome comparison by disease type
 - Demographic disparities
 - Admission type trends
- Extend the analysis to **predictive modeling** (using regression or classification) for early detection of high-risk hospitals.

End of Report

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