Healthcare Analytics Project Report

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Problem Statement

Hospitals face challenges in managing patient outcomes, operational efficiency, and cost control. With increasing patient volumes and varied medical conditions, data-driven decisions are essential to improve service quality and reduce overhead.

Project Objective

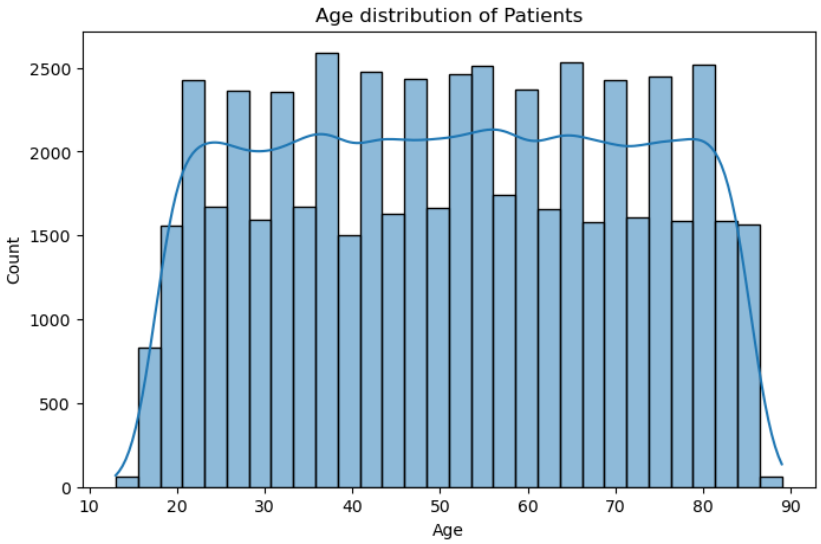
Analyze patient records and healthcare operations to generate actionable insights. Enhance patient care, optimize resources, and reduce costs.

Methodology

- Data Cleaning & Preparation
- Exploratory Data Analysis (EDA)
- Data Visualization using Python (Matplotlib, Seaborn)
- Hypothesis Testing using Scipy (t-tests)
- Report and Recommendation Generation

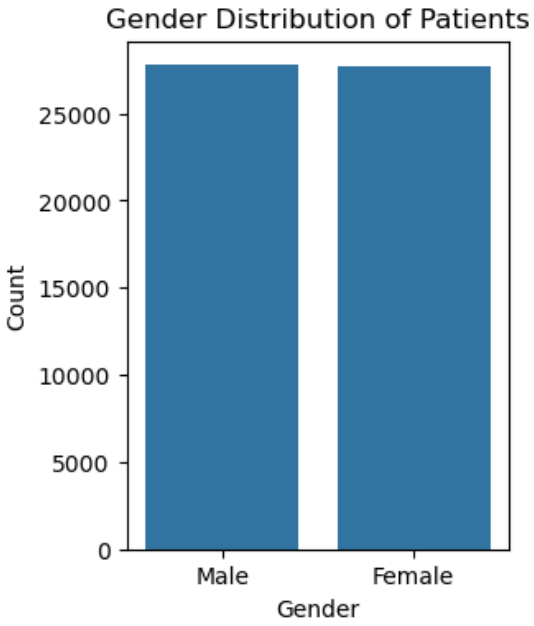
Analysis

1. Age Distribution



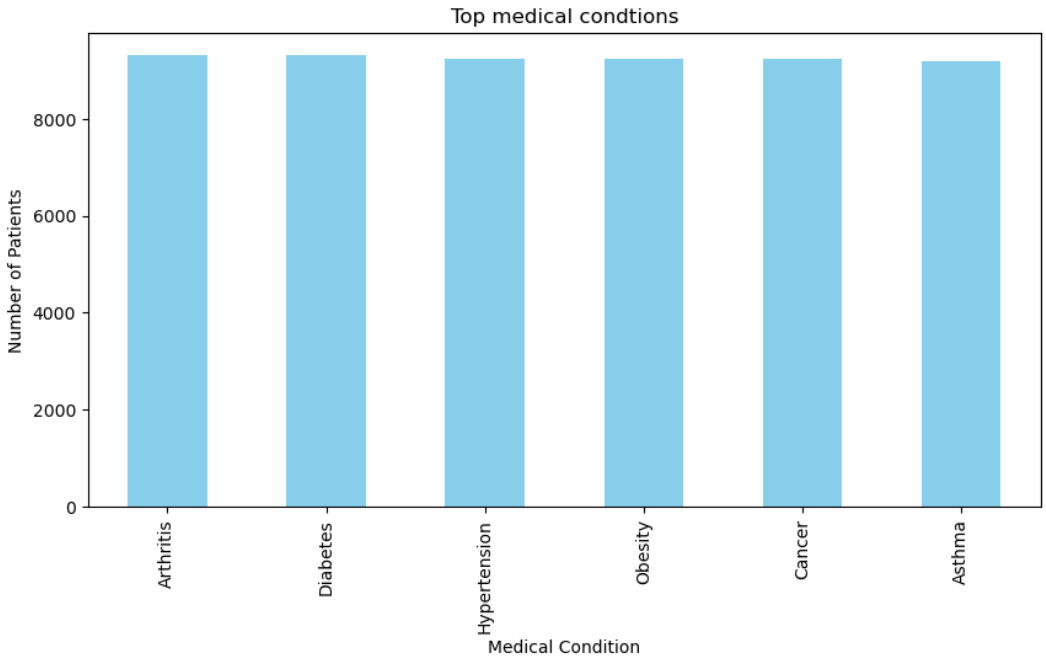
Insight: Most patients are aged between 30–60, indicating a need for middle-aged wellness programs.

2. Gender Distribution



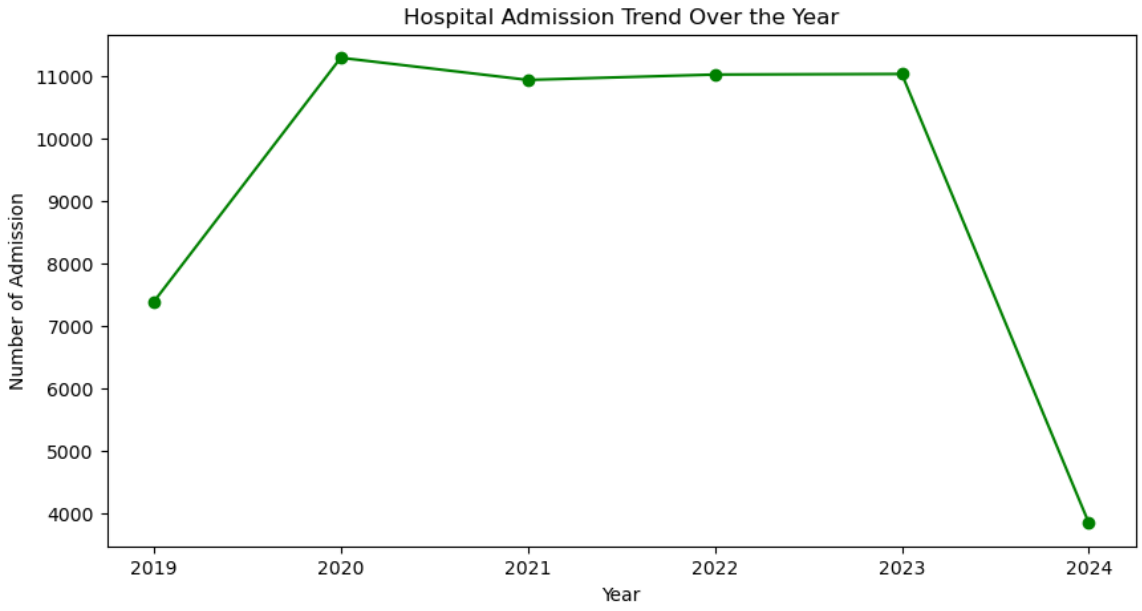
Insight: Gender distribution is almost equal. Ensure gender-equitable healthcare delivery.

3. Top Medical Conditions



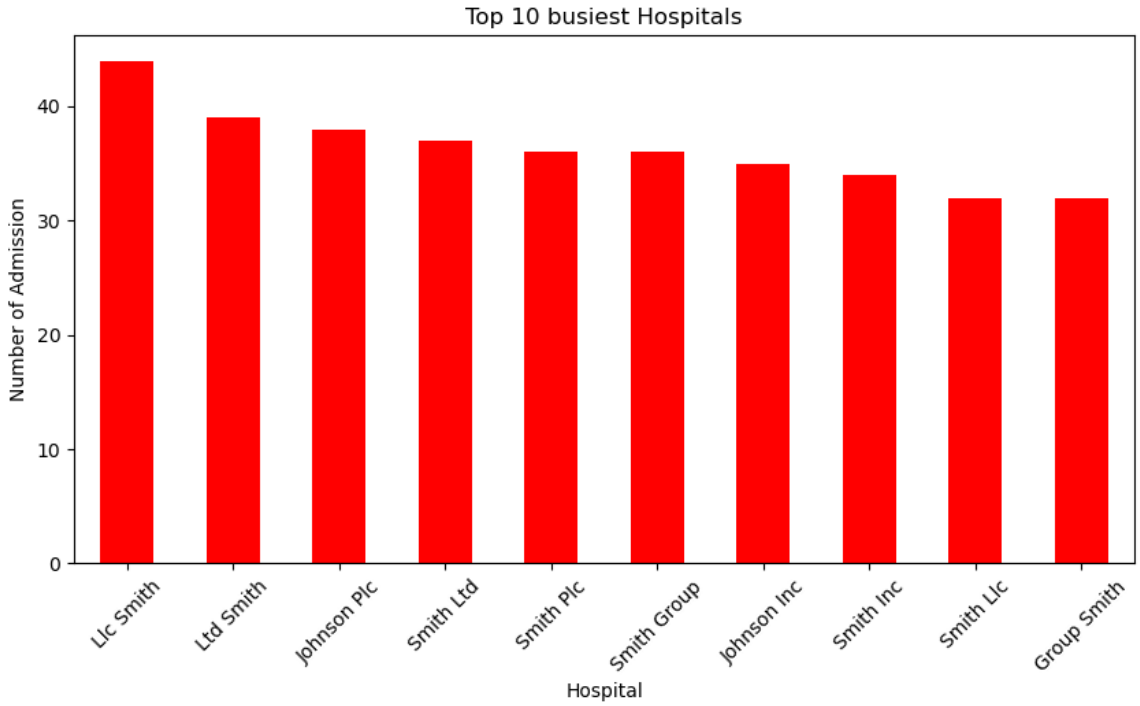
Insight: Arthritis, Diabetes, and Hypertension are most prevalent.

4. Hospital Admission Trend Over the Year



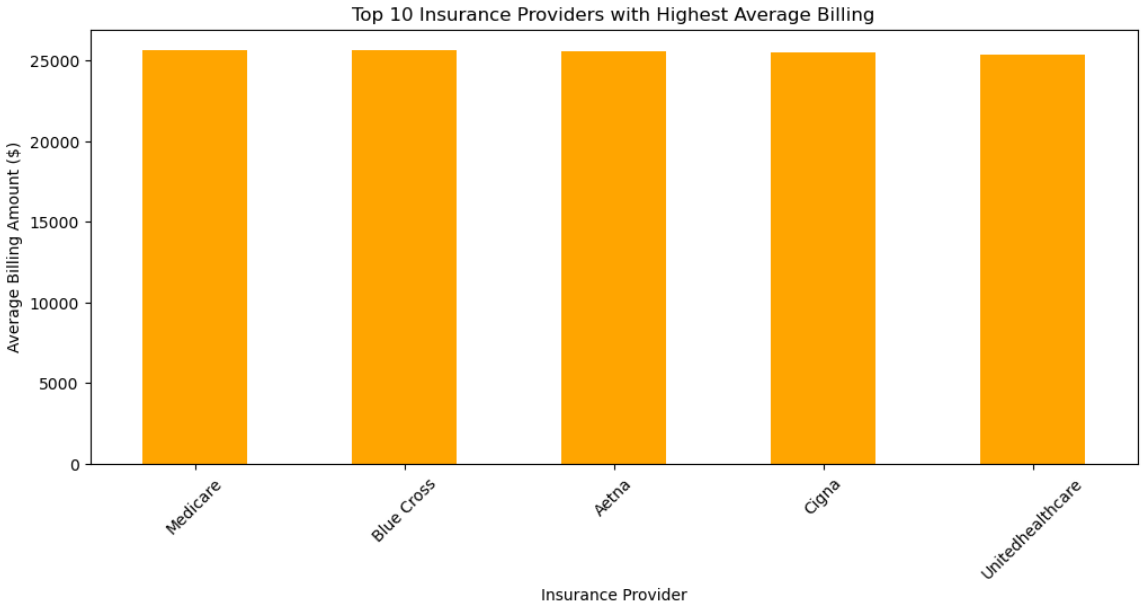
Insight: Admissions are steady over the years.

5. Top 10 Busiest Hospitals



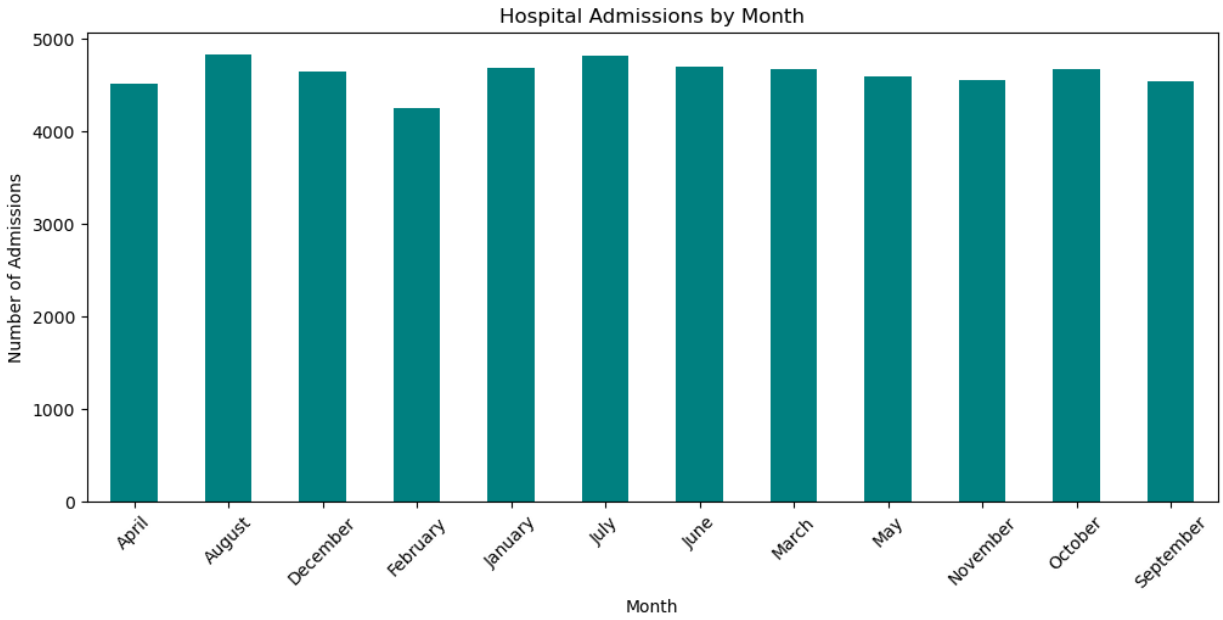
Insight: Certain hospitals handle high volumes and need operational support.

6. Top Medical Condition with Longest Average Hospital Stay



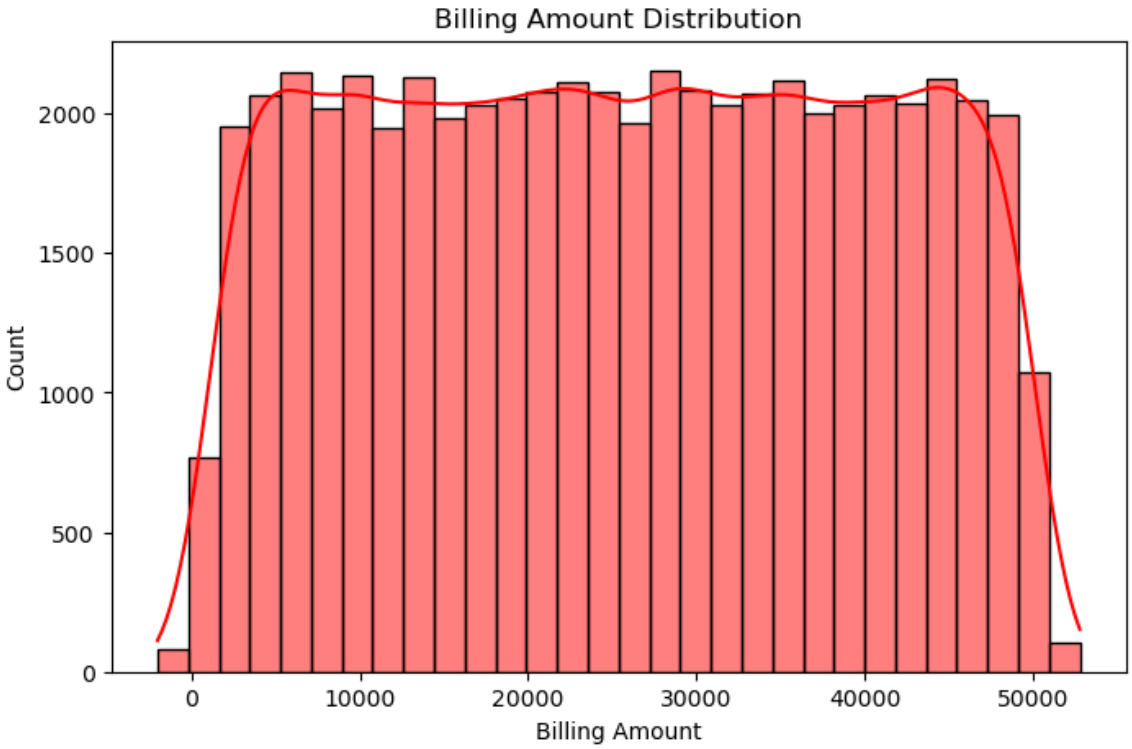
Insight: Asthma and Cancer have the longest stays.

7. Hospital Admissions by Month



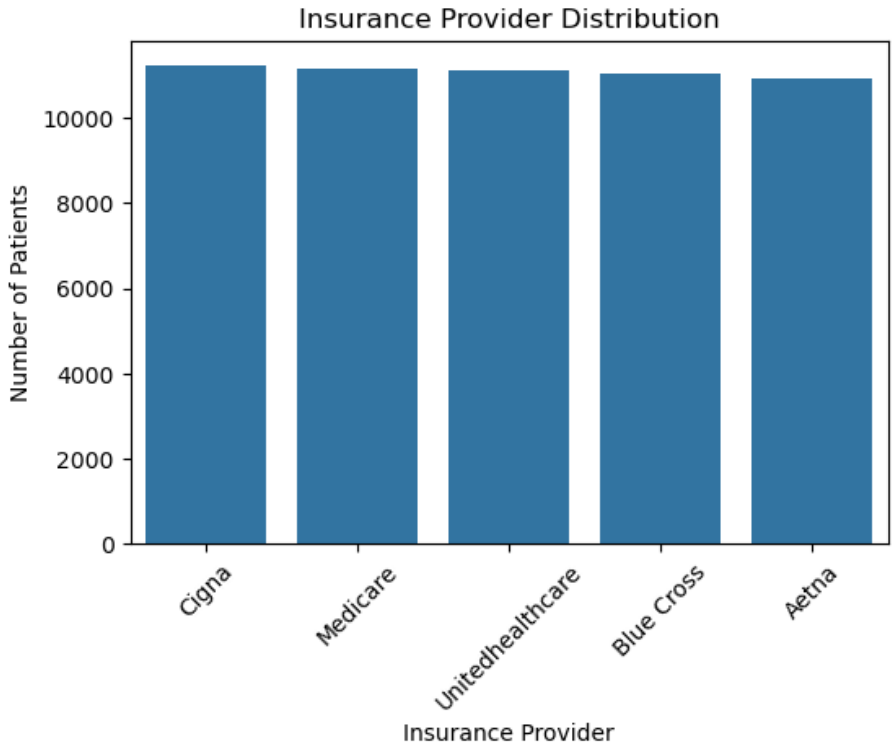
Insight: Admissions peak in Aug–Oct.

8. Billing Amount Distribution



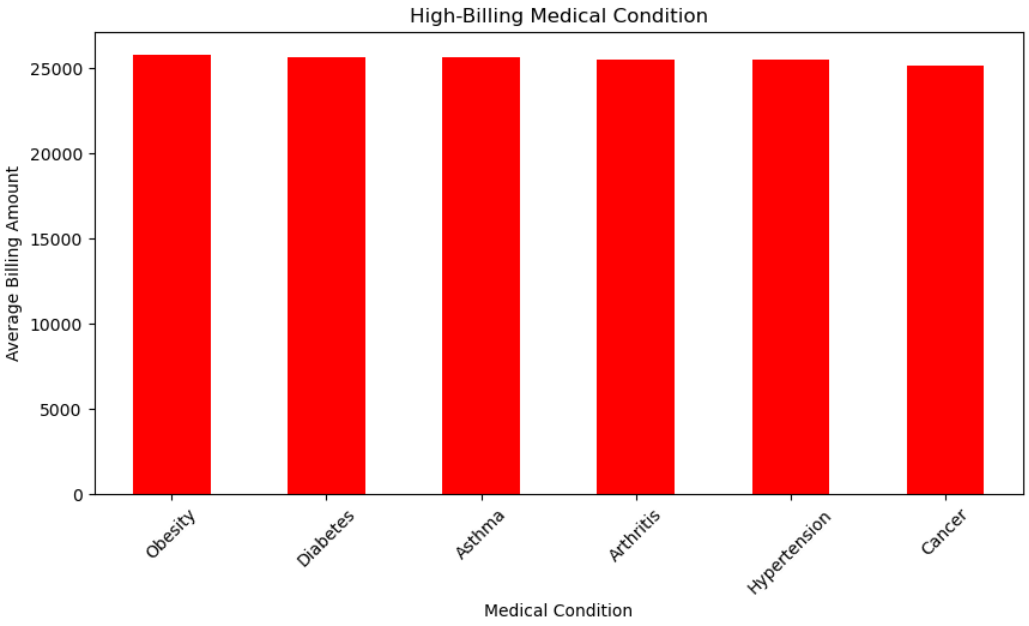
Insight: Most bills range from $20,000 to $30,000.

9. Insurance Provider Distribution



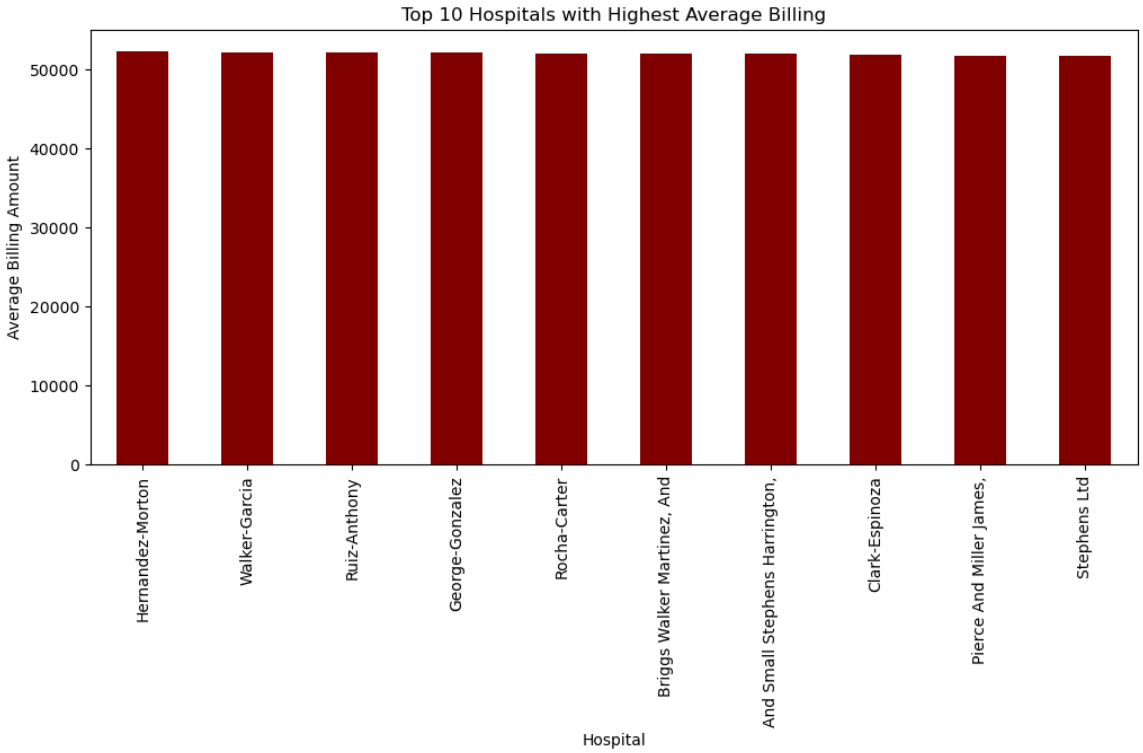
Insight: Majority of patients use providers like Cigna and Medicare.

10. High-Billing Medical Condition



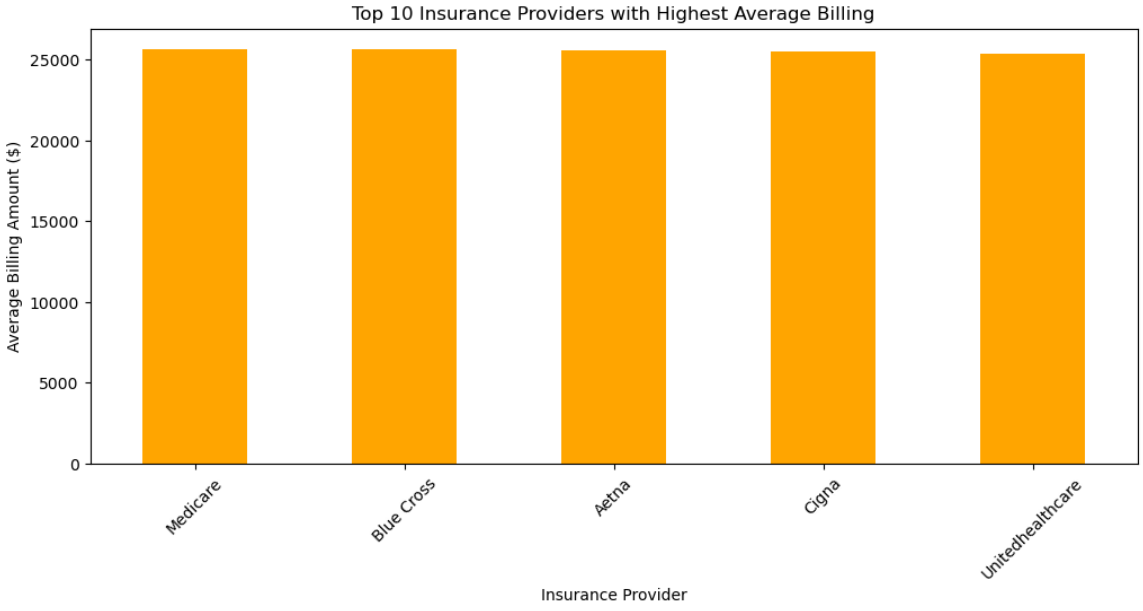
Insight: Obesity and Diabetes have the highest average billing.

11. Top 10 Hospitals with Highest Average Billing



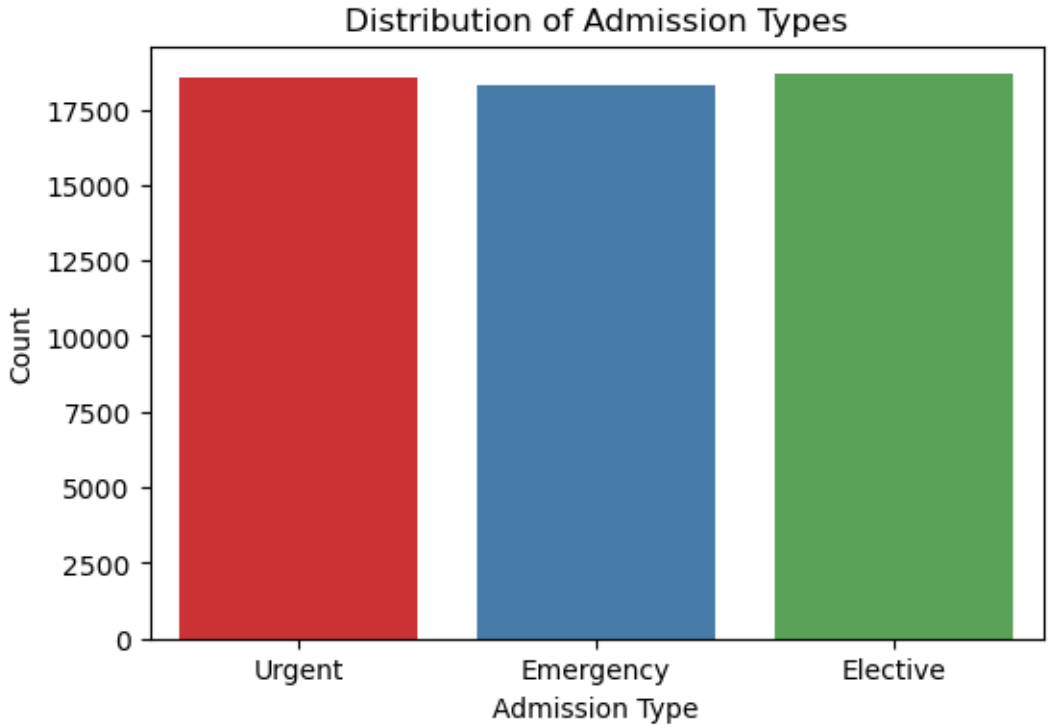
Insight: Billing varies significantly by hospital.

12. Top 10 Insurance Providers with Highest Average Billing



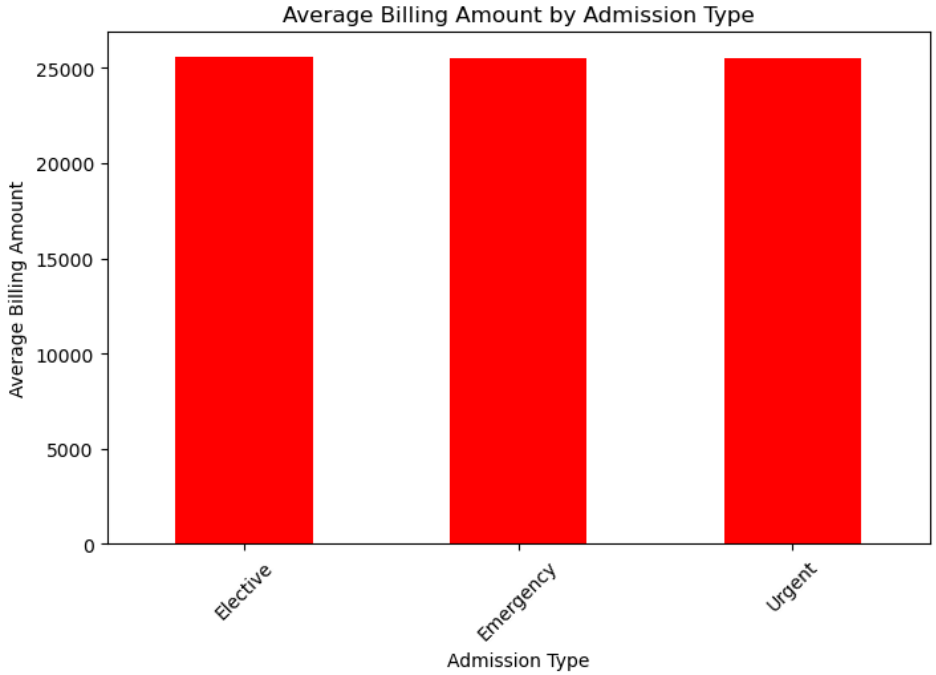
Insight: Billing trends vary across providers.

13. Distribution of Admission Types



Insight: Most admissions are urgent or emergency.

14. Average Billing Amount by Admission Type



Insight: Elective admissions are more expensive on average.

15. Hypothesis Testing Summary

- Cigna vs Aetna Billing → No significant difference (p = 0.8857)
- Urgent vs Elective Billing → No significant difference (p = 0.5652)
- Male vs Female Stay Duration → No significant difference (p = 0.3167)

Strategic Recommendations

- ✓ **Prioritize chronic disease management** for high-frequency, high-cost conditions like **Arthritis, Diabetes, Obesity, and Asthma** through specialized clinics and preventive care.
- ✓ **Optimize resources during peak months (August–October)** by preparing surge capacity, scheduling elective procedures in off-peak periods, and aligning staff planning.
- ✓ **Standardize treatment packages and billing procedures** across hospitals to reduce cost variability and ensure transparency.
- ✓ **Enhance triage and admission classification protocols** to reduce the burden of unnecessary urgent/emergency admissions.
- ✓ **Monitor and reduce length of stay (LOS)** for patients with conditions showing prolonged hospitalization using care coordinators and discharge planning.
- ✓ **Equip high-traffic hospitals** (e.g., top 10 busiest) with additional infrastructure and explore redistribution strategies for elective cases.
- ✓ **Negotiate more efficient contracts with insurance providers** based on performance data (e.g., billing vs. care effectiveness).
- ✓ **Implement early intervention and lifestyle programs** for at-risk age groups (30–60 years), the most frequent patient demographic.
- ✓ **Improve cost efficiency for elective admissions**, which tend to incur higher billing, by exploring outpatient or day-care alternatives.

Conclusion

This project provided valuable insights into healthcare data and hospital operations. By leveraging analytics, hospitals can make more informed decisions, deliver better care, and manage resources effectively.