**Enhancing Hospital Performance and Patient Outcomes Through SQL-Based Exploratory Data Analysis by Karen Ambrose**

About the data

Synthetic data on ~1k patients of Massachussets General Hospital from 2011-2022, including information on patient demographics, insurance coverage, and medical encounters & procedures.

Problem Statement

Massachussets General Hospital face multiple operational challenges, including:

1. Inefficient Resource Allocation: Overcrowding in emergency units while some departments remain underutilized.
2. High Medical Costs & Insurance Disparities: Patients struggle with unpredictable medical expenses, and some treatments are inadequately covered by insurance.
3. Limited Insights into Patient Health Trends: A lack of comprehensive analysis on patient demographics, common illnesses, and treatment effectiveness.
4. Hospital Performance & Service Quality Issues: Inconsistent patient care, varying encounter volumes, and inadequate performance tracking across hospitals.

To improve healthcare efficiency, patient satisfaction, and financial sustainability, the hospital must leverage data-driven decision-making.

As an Analytics Consultant, I will conduct Exploratory Data Analysis (EDA) using SQL to uncover key insights from the hospital’s data. My approach will involve:

1. Performing EDA on Patient Data: Using SQL queries to analyze patient volumes, encounters, length of stay, and common health trends.
2. Evaluating Costs & Insurance Coverage: Extracting insights on average encounter costs, insurance coverage gaps, and financial trends.
3. Conducting Procedure Analysis: Leveraging SQL to uncover the frequency, cost, and trends of medical procedures, while identifying the most commonly performed procedures.
4. Analyzing Mortality Rates: Using SQL queries to evaluate patient mortality rates, analyzing factors such as age, condition type, procedure involvement, and identifying correlations that may improve patient care and outcomes.

Process

1. **Exploratory Data Analysis (EDA) on Patients and their encounters.**

Query Questions:

1. How many patients visited the hospital per year between 2011 and 2022?
2. Which cities have the most hospital patients?
3. What is the average length of stay per encounter?
4. What are the top 5 most common encounters among patients?
5. What is the distribution of patient encounters by age group?
6. What is the gender distribution of patients?
7. What is the gender distribution of patients across illnesses?
8. What is the racial and ethnic distribution of patients?
9. How many encounters were recorded for each encounter type?
10. What are the busiest days of the week for patient encounters?
11. How does the average length of stay vary by encounter type?
12. **Evaluation of cost and insurance coverage**

Query Questions:

1. What is the average total claim cost per encounter type?
2. How much of the total claim cost is covered by insurance (payer coverage)?
3. What is the distribution of total claim costs by encounter type?Use Case: Improve hospital resource allocation by analyzing procedures.
4. **Analysis of Procedures**

Query Questions:

1. What are the most common medical procedures performed in the hospital?
2. What are the most expensive medical procedures?
3. What are the most common procedures used for specific health conditions?
4. How many patients undergo multiple procedures (i.e., more than 3)?
5. Why does Kimberly have the most procedures?
6. At what age did Kimberly start the procedure?
7. **Mortality Rate Analysis**

Query Questions:

1. What percentage of patients in the database are deceased?
2. What is the average age at which patients pass away?
3. What are the mortality trends over time?
4. Which chronic diseases have the highest death rates?

Recommendations

**Recommendations Based on Analysis**

**A. Exploratory Data Analysis on Patient Encounters & Health Trends**

1. Increase resources and staff on Mondays to address the high influx of patients.
2. Prioritize care and outreach programs for patients aged 65+, who visit the hospital most frequently.
3. Evaluate the efficiency of periodic reevaluation procedures to optimize hospital stays.
4. Implement targeted initiatives for cities like Boston, which have the highest patient numbers.

**B. Cost & Payer (Insurance) Coverage Analysis**

1. Focus on partnerships with top-performing insurance providers (e.g., Medicaid, Medicare, Blue Cross Blue Shield) to ensure adequate patient coverage.
2. Conduct efficiency audits for ambulatory care to manage high total claim costs.
3. Strategize cost management for inpatient encounters, given their higher average claim costs.

**C. Procedure Analysis**

1. Investigate reasons for high frequency of renal dialysis procedures and identify preventive measures for conditions leading to kidney failure.
2. Enhance support and awareness campaigns for substance and alcohol addiction to reduce repeat procedures.
3. Optimize procedural cost management for expensive treatments like ICU procedures and chemotherapy.
4. Expand programs for atrial fibrillation care, given the high use of electrical cardioversion procedures.

**D. Mortality Rate Analysis**

1. Develop specialized care plans for chronic diseases with high mortality rates, such as kidney failure and heart conditions.
2. Address mortality trends by reviewing hospital policies and care quality from 2016–2021.
3. Strengthen palliative and geriatric care services to cater to the elderly demographic, given the average age at death is 79.
4. Use data insights to enhance early intervention strategies for high-risk chronic conditions.