**SigmaCare Data Analysis Case Study**

**Company**: SigmaCare  
**Industry**: Healthcare  
**Project Title**: Analyzing Patient Healthcare Data for Optimized Clinical and Financial Outcomes

**Case Study Overview**

**Goal**  
The primary goal of this case study is to analyze SigmaCare’s patient healthcare records, focusing on optimizing healthcare delivery, improving patient outcomes, and reducing operational costs. By leveraging the data archived by SigmaCare, we will identify key trends, potential inefficiencies, and areas of improvement within the patient care cycle. This analysis will aid SigmaCare in delivering higher quality, more efficient healthcare services while managing costs and improving patient satisfaction.

**Key Performance Indicators (KPIs)**

1. **Average Length of Stay (ALOS)**
   * **Description**: The average time a patient stays in the hospital from admission to discharge.
   * **Benchmark**: SigmaCare aims to maintain an ALOS of 4 days or lower for elective admissions to minimize hospital bed usage while ensuring optimal patient outcomes.
   * **Analysis Approach**:
     + Use SQL to calculate the difference between the "Discharge Date" and "Date of Admission" for each patient.
     + Use Excel to compute the average length of stay across all patient categories.
     + Use Power BI to visualize trends in ALOS for different hospitals, medical conditions, and admission types.
2. **Patient Re-admission Rate**
   * **Description**: The percentage of patients readmitted to the hospital within 30 days of discharge.
   * **Benchmark**: Target re-admission rate is below 8% to demonstrate effective treatment and long-term health improvement.
   * **Analysis Approach**:
     + Identify patients re-admitted within 30 days by comparing multiple admission dates for the same patient.
     + Use SQL to track re-admission rates by "Medical Condition" and "Doctor" to identify any patterns that may suggest improvement areas.
     + Power BI can be used to highlight re-admission rates across hospitals, departments, and patient demographics for targeted interventions.
3. **Billing Amount per Admission**
   * **Description**: The average billing amount per patient admission across different hospitals and medical conditions.
   * **Benchmark**: SigmaCare aims to maintain an average billing amount that is competitive with industry standards and reflective of efficient care. The target is $3,500 per admission.
   * **Analysis Approach**:
     + Use SQL to aggregate the "Billing Amount" for each patient and categorize it by "Medical Condition," "Doctor," and "Insurance Provider."
     + Use Excel to compute the average billing amount per admission type (Elective, Emergency, Urgent).
     + Visualize billing patterns across different hospitals and admission types using Power BI to identify opportunities for cost management.
4. **Test Result Accuracy and Outcomes**
   * **Description**: Track the percentage of "Abnormal" or "Inconclusive" test results and the impact on patient outcomes (e.g., length of stay, readmission rates, etc.).
   * **Benchmark**: Reduce the rate of "Inconclusive" results to below 5% through better diagnostics and improve patient outcomes as a result.
   * **Analysis Approach**:
     + Use SQL to categorize test results into "Normal," "Abnormal," or "Inconclusive" and analyze the relationship between test result types and re-admission rates.
     + Use Excel to assess the frequency of each result type and correlate them with patient outcomes such as ALOS and re-admission rate.
     + Create Power BI dashboards that visualize test results across medical conditions and track diagnostic improvements over time.

**Data Analysis Tools & Techniques**

1. **SQL (Structured Query Language)**
   * **Purpose**: SQL will be used to query and manipulate the large dataset stored in SigmaCare’s data archive. SQL queries will enable the team to filter, sort, and aggregate data efficiently to support different levels of analysis.
   * **Key Tasks**:
     + Calculate average length of stay.
     + Identify readmission patterns.
     + Aggregate billing amounts.
     + Track test result outcomes.
2. **Excel**
   * **Purpose**: Excel will be used to perform basic statistical analysis, create pivot tables, and provide a quick overview of the data. It will also serve as a tool for computing averages, percentages, and other essential metrics before visualization.
   * **Key Tasks**:
     + Calculate averages (e.g., ALOS, billing amount).
     + Create summary tables.
     + Generate basic charts to complement insights.
3. **Power BI**
   * **Purpose**: Power BI will be used to create dynamic, interactive dashboards that present the insights from the data analysis in a visually appealing manner. These dashboards will allow stakeholders to explore KPIs across various dimensions such as time, hospital, medical condition, and doctor.
   * **Key Tasks**:
     + Visualize trends in ALOS, billing amount, and re-admission rates.
     + Create interactive filters for analyzing patient demographics, test results, and outcomes.
     + Enable real-time monitoring of the hospital’s performance against key benchmarks.

**Deliverables**

1. **Data Cleaning & Preprocessing**
   * Ensure the dataset is cleaned and organized for effective analysis. This includes removing duplicates, addressing missing values, and normalizing categories (e.g., ensuring consistent values for gender, hospital names, medical conditions, etc.).
2. **SQL Queries for Data Extraction**
   * Deliver pre-defined SQL queries to extract key data points related to the KPIs. The queries will include custom filters for demographics, hospitals, admission types, and medical conditions.
3. **Excel-Based Analytical Report**
   * A detailed Excel report with pivot tables and basic charts providing insights into patient admission trends, billing patterns, and outcomes.
4. **Power BI Dashboard**
   * An interactive Power BI dashboard that visualizes key performance metrics, allowing SigmaCare’s leadership to explore trends and patterns in real-time.
5. **Insights & Recommendations**
   * A final report summarizing key findings from the analysis, including actionable recommendations for reducing patient re-admission rates, optimizing billing amounts, and improving diagnostic outcomes.

**Conclusion**

By conducting a thorough analysis of SigmaCare’s patient healthcare data, the company will gain critical insights into their operational efficiency, patient outcomes, and financial health. The deliverables from this project will not only enable SigmaCare to track and improve their performance on key metrics but will also support data-driven decision-making for future patient care strategies.