MANIPAL HOSPITAL CASE STUDY

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Problem Statement:

Manipal Hospital has been grappling with escalating healthcare costs, inconsistent patient outcomes, and strained resources, leading to operational inefficiencies. In addition, inconsistencies in insurance billing have resulted in complications and delayed payments. The synthetic healthcare dataset is designed to mimic real-world scenarios to help analyze and resolve these issues. As a Business Analyst, your mission is to identify cost drivers, reduce healthcare costs, improve patient outcomes, optimize resource allocation, and streamline insurance billing processes.

Dataset Information:

The dataset includes the following columns for analysis:

1. **Name**: Patient's name.
2. **Age**: Patient's age (ranging from 13 to 90).
3. **Gender**: Patient's gender.
4. **Blood Type**: Patient's blood type (e.g., A+, O-, etc.).
5. **Medical Condition**: Description of the patient's medical condition (e.g., diabetes, hypertension, etc.).
6. **Date of Admission**: Date when the patient was admitted to the hospital.
7. **Doctor**: Name of the attending doctor.
8. **Hospital**: Name of the hospital where the patient was admitted.
9. **Insurance Provider**: The patient's insurance provider.
10. **Billing Amount**: Total medical bill for the patient's treatment.
11. **Room Number**: Room number where the patient was accommodated.
12. **Admission Type**: Type of admission (e.g., emergency, routine).
13. **Discharge Date**: Date when the patient was discharged from the hospital.
14. **Medication**: Medication administered during the hospital stay.
15. **Test Results**: Results of medical tests (e.g., normal, abnormal).
16. **Length of Stay (Days**): Number of days the patient stayed in the hospital.
17. **Age Groups**: Categorized age groups for patients.

18. **Cost Per Day**: The cost incurred per day during the hospital stay.
19. **Test Result Indicator (Abnormality**): Indicator for whether test results were abnormal (yes/no).

Objectives:

- **Cost Analysis:** Identify key drivers of high medical costs and suggest ways to reduce them.
- **Patient Outcome Analysis:** Investigate the factors contributing to inconsistent patient outcomes across hospitals.
- **Resource Allocation Optimization**: Analyze patient admissions and length of stay to improve hospital resource management.
- **Insurance and Billing Analysis**: Streamline the insurance billing process by identifying inconsistencies and improving payment reliability.

Data Cleaning and Preprocessing :

1. **Name Formatting:** Corrected improper name formats such as "Aaron RoDGers" by applying the PROPER() function to standardize all names.
2. **Duplicate Removal:** Removed 534 duplicate rows, reducing the dataset from 55,500 rows to 54,966.
3. **Data Type Corrections**: Ensured correct data types for various columns to facilitate accurate analysis (e.g., dates, numerical values, and categorical data).
4. **Hospital Name Cleaning**: Corrected hospital names that had leading or trailing commas and the word "and." Used the following formulas:
    a. Remove "and" from the beginning: =IF(LEFT(H2, 4) = "and ", MID(H2, 5, LEN(H2)), H2)
    b. Remove "and" from the end: =IF(RIGHT(B2, 4) = " and", LEFT(B2, LEN(B2)-4), B2)
5. **Length of Stay (Days):** Created a new column calculating the length of stay by subtracting the admission date from the discharge date.
6. **Additional Columns Created:**
    a. **Age Groups**: Grouped patients into different age brackets for analysis.

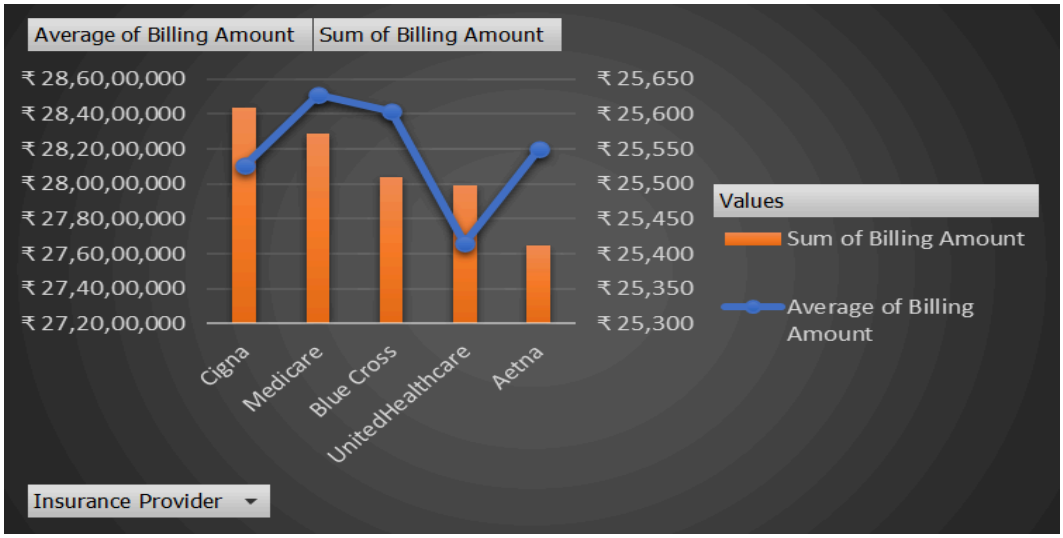
b. **Cost Per Day:** Calculated the cost per day by dividing the billing amount by the length of stay.
c. **Test Result Abnormality**: Added a column indicating whether test results were abnormal.

Proposed KPIs and Analytical Questions

1. **What key performance indicators (KPIs) would you recommend for tracking patient admission trends and hospital performance based on this dataset?**

   Ans) As a Business Analyst, I recommend the following KPIs:
   - **Average Length of Stay:** Track the average duration patients remain in the hospital to identify trends in resource utilization and care efficiency. A decreasing average could indicate improved discharge processes.
   - **Average Billing Amount per Admission:** Monitor the average costs associated with patient admissions to assess financial performance. Analyzing variations across admission types can help identify cost drivers.
   - **Admission Type Distribution**: Evaluate the proportion of admissions categorized as Emergency, Elective, and Urgent. This KPI provides insights into hospital capacity and patient flow, allowing for better resource allocation and planning for peak times.

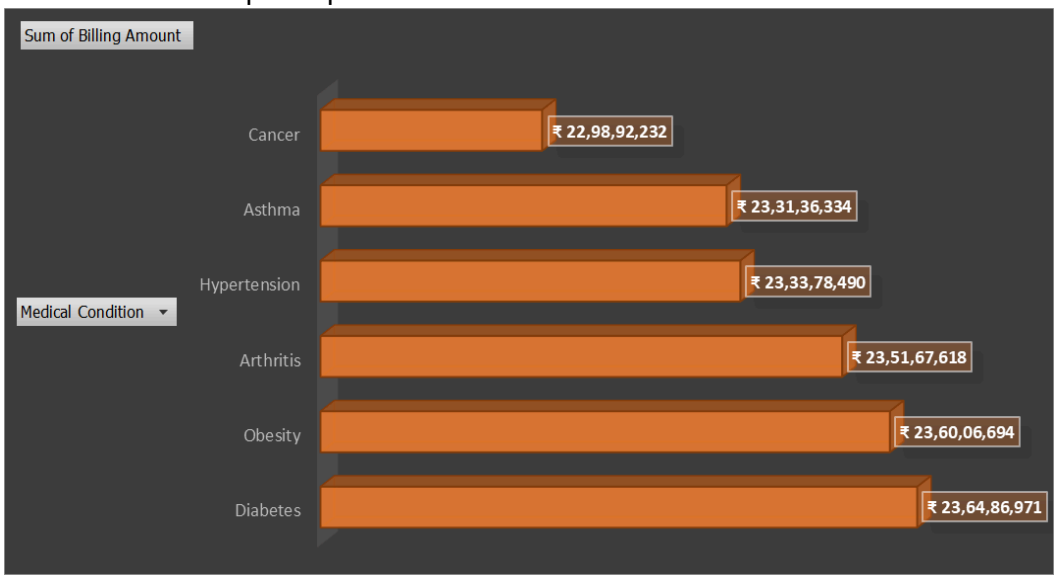
2. **How would you analyze the relationship between "Insurance Provider" and "Billing Amount" to find potential correlations?**
   Ans) The analysis had the below mentioned insights and recommendation:
   - **Similar Average Costs:** The average billing amounts for all insurance providers are quite close, between ₹25,415 and ₹25,628. This shows that billing practices are likely similar across these providers.
   - **Total Billing Differences**: Cigna has the highest total billing amount, while UnitedHealthcare has the lowest, even though their average costs are similar. This means that Cigna processes more claims than UnitedHealthcare, which could be worth looking into.
   - **Negotiation Advice:** Hospitals can use this information to negotiate better payment rates with insurance companies. By understanding these billing trends, they can ask for fairer payments, especially from providers like Cigna that handle more claims.



3. **Based on the dataset, how could you assess which medical conditions result in higher billing amounts?**

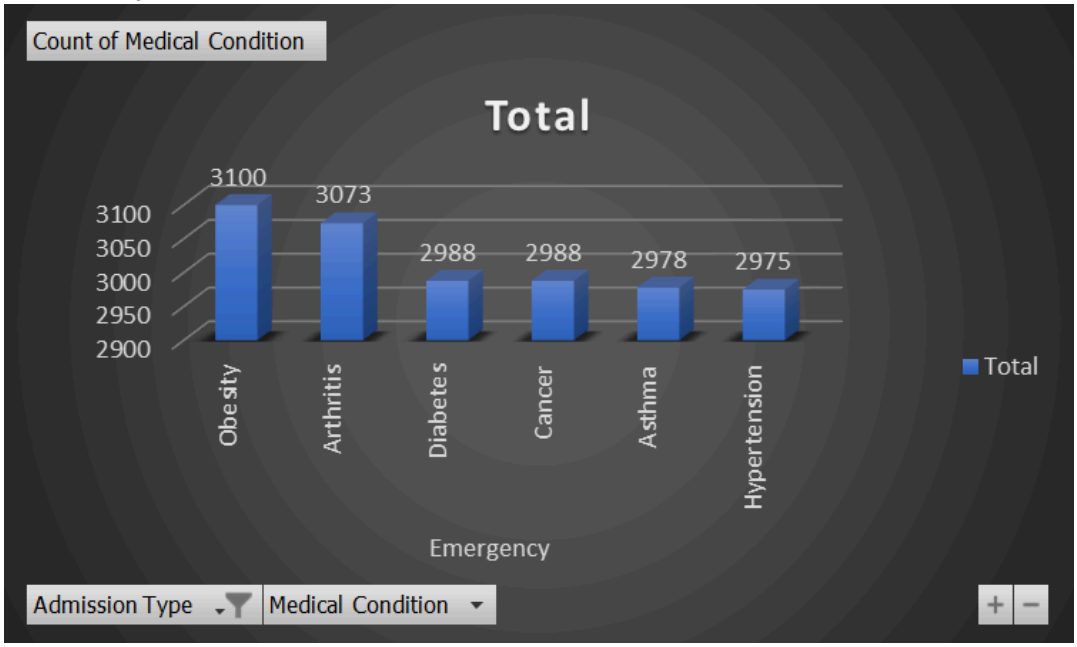
Ans) The analysis had the below mentioned insights and recommendation:

- **High Costs for Common Conditions**: Diabetes and Obesity have the highest billing amounts, meaning they are common and expensive to treat.
- **Focus on Prevention**: Hypertension and Asthma also cost a lot. Hospitals should focus on prevention and management programs to help reduce these costs in the future.
- **Special Programs**: By understanding which conditions lead to higher bills, hospitals can create special programs to help patients with diabetes and obesity. This can improve patient health and lower overall costs.

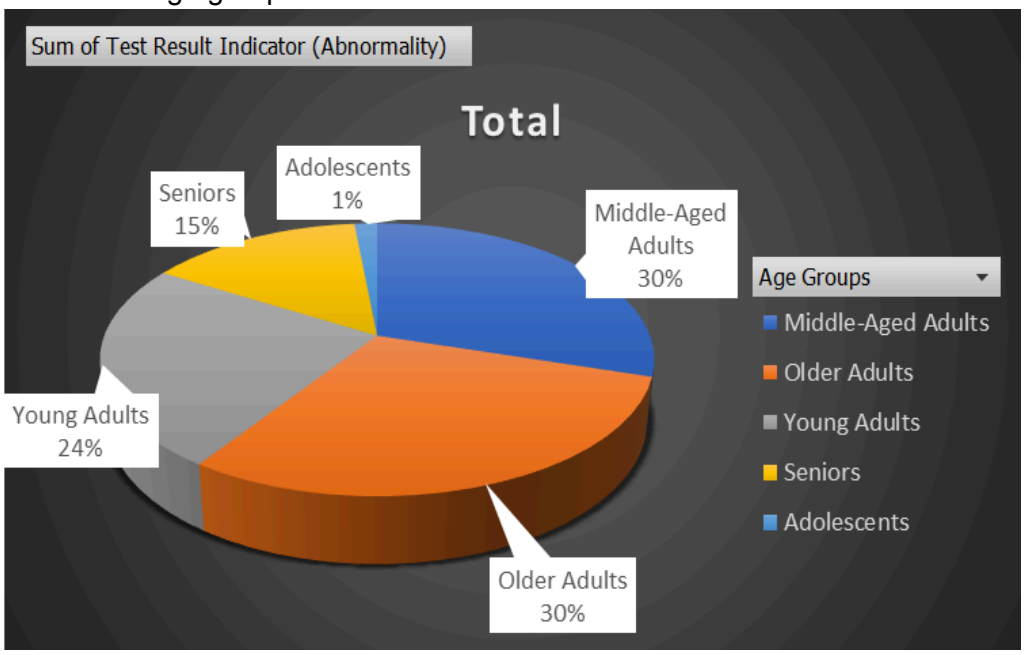


4. **If you were tasked with creating a pricing model for healthcare services based on "Billing Amount," what features from this dataset would you consider most important?**
   Ans) When creating a pricing model for healthcare services based on "Billing Amount," the most important features to consider are:
   - **Medical Condition:** Different conditions like diabetes or cancer have varying treatment costs, so it's crucial to categorize billing amounts by specific medical conditions.
   - **Admission Type**: The type of admission (emergency, elective, urgent) significantly impacts costs. Understanding how each admission type affects billing can help refine pricing strategies.
   - **Length of Stay:** Analyzing the average length of stay for patients can provide insights into resource usage and costs, helping to create more accurate pricing based on expected service durations.

5. **How would you identify the most common medical conditions leading to emergency admissions?**
   Ans) The analysis had the below mentioned insights and recommendation:
   - **Common Conditions**: The data shows that there are a lot of emergency admissions (18,102 in total), mostly due to conditions like obesity, arthritis, diabetes, cancer, asthma, and hypertension.
   - **Focus on Obesity**: Obesity leads to the most admissions (3,100). This means that tackling obesity could help reduce the number of emergency visits.
   - **Preventive Programs**: Hospitals should create programs to help prevent obesity and manage chronic diseases. By educating patients about healthy lifestyles and providing support, hospitals can lower emergency admissions and help patients stay healthier.

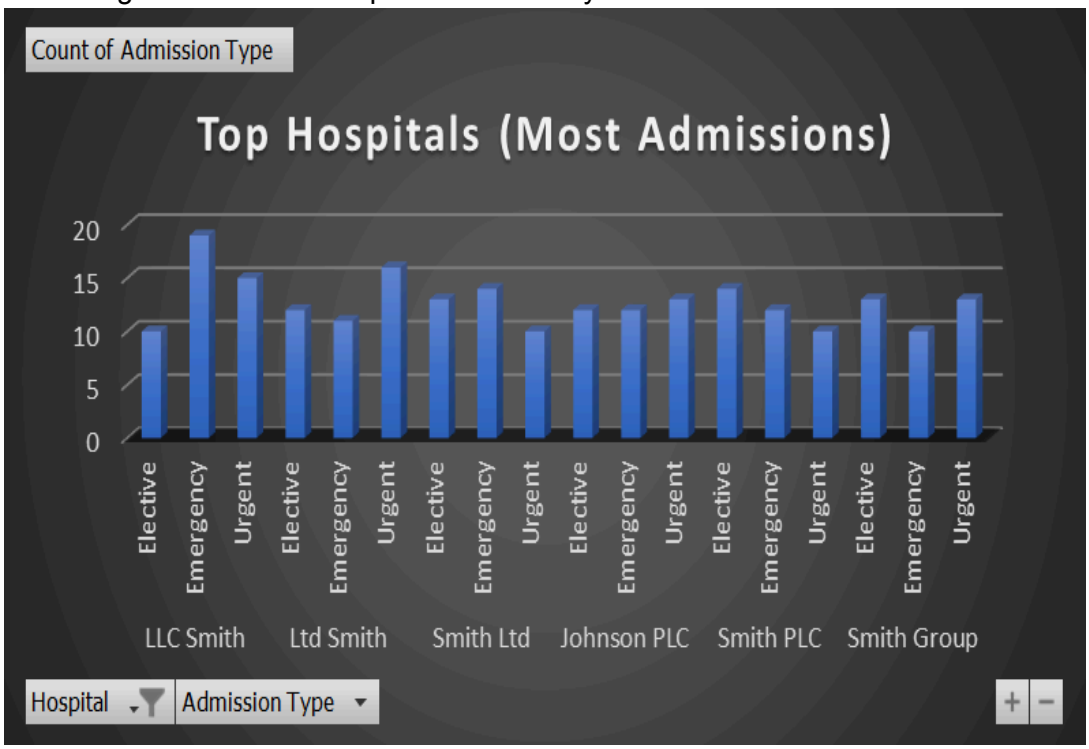


6. **How would you assess the impact of a patient's age on their likelihood of having abnormal test results?**
   Ans) The analysis had the below mentioned insights and recommendation:
   - **Higher Abnormal Results in Adults**: The data shows that middle-aged adults (5488) and older adults (5464) have the highest number of abnormal test results. This suggests that these age groups may have a greater risk of health issues.
   - **Lower Rates in Younger Groups**: Young adults (4471), seniors (2725), and adolescents (289) show fewer abnormal results, indicating that younger individuals may be healthier or have fewer chronic conditions.
   - **Targeted Health Programs**: Hospitals should focus on preventive care and health education for middle-aged and older adults. This could include regular screenings and lifestyle programs to help reduce the risk of abnormalities in these age groups.

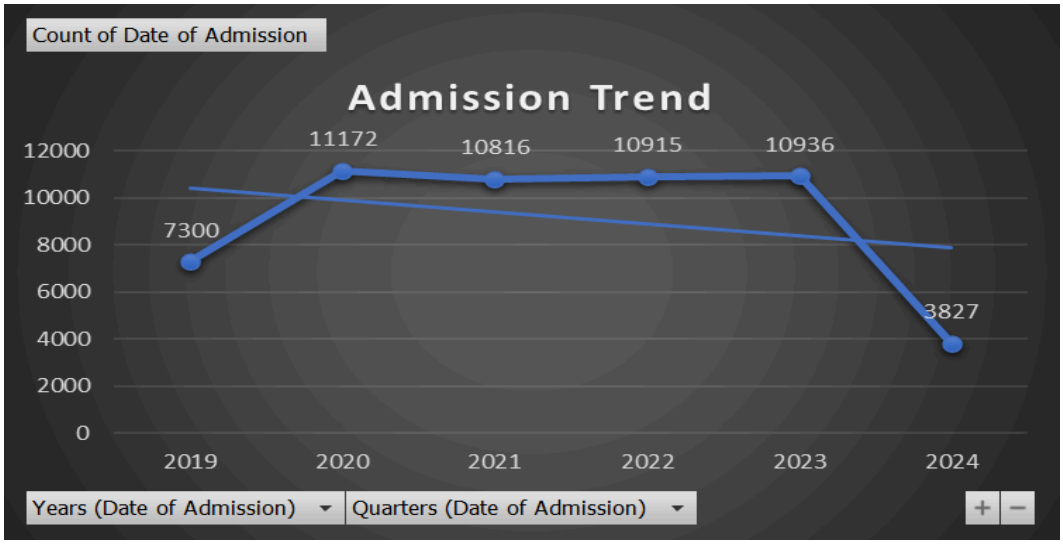


7. **How would you measure the time patients spend in hospitals, and which factors influence longer stays?**
   Ans) The analysis had the below mentioned insights and recommendation:
   - **Average Length of Stay**: The overall average length of stay in the hospital is 15 days. This shows that patients generally spend a similar amount of time, regardless of their condition or age group.
   - **Factors Affecting Longer Stays**: Conditions like Hypertension and Diabetes tend to result in longer hospital stays (up to 19 days for Diabetes). This suggests that these health issues may need more attention and resources for effective management.
   - **Targeted Interventions**: Hospitals should focus on improving care for patients with chronic conditions like Hypertension and Diabetes to help reduce their length of stay. Implementing better management programs for these patients could lead to shorter stays and better outcomes.

8. **How would you visualize the number of admissions per "Hospital" and "Admission Type" using Excel?**
   Ans) The analysis had the below mentioned insights and recommendation:
   - **Elective Admissions**: Elective admissions account for the lowest number across most providers, suggesting that urgent and emergency cases dominate hospital admissions.
   - **Urgent vs. Emergency:** Urgent and emergency admissions show similar counts, indicating high demand for immediate care services across all providers.
   - **Top Providers:** LLC Smith has the highest total number of admissions (44), followed by Ltd Smith (39) and Smith Ltd (37), highlighting these providers' significant role in hospital care delivery.



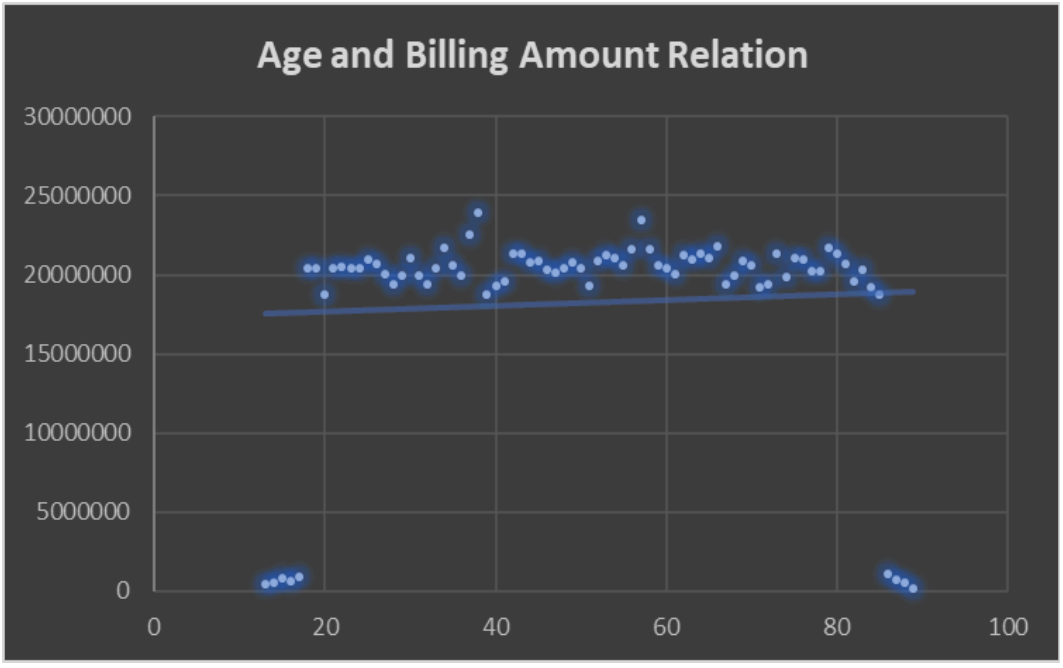
9. **How would you use Excel to create a line chart showing the trend of patient admissions over time, based on the "Date of Admission" column?**
   Ans) The analysis had the below mentioned insights and recommendation:
   - **Peak Admissions in 2020:** Admissions spiked in 2020, with 11,172 patients.
   - **Steady Numbers Post-2020:** From 2021 to 2023, admissions stabilized around 10,800-11,000 annually, indicating a return to a more consistent patient flow after the pandemic peak.
   - **2024 Lower So Far:** With only 3,827 admissions in 2024, the lower count suggests incomplete data for the year, or a potential reduction in hospital visits during the early months of the year.



10. **How would you use a scatter plot in Excel to visualize the relationship between "Age" and "Billing Amount"?**

Ans) The analysis had the below mentioned insights and recommendation:

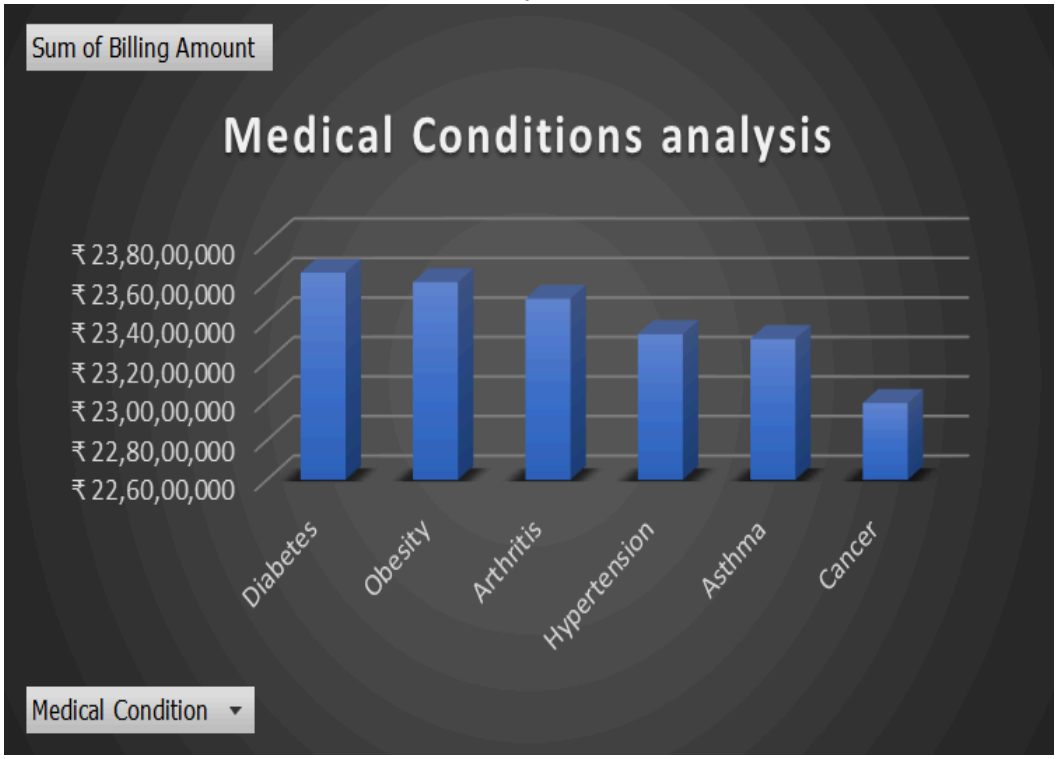
- **Spike in Billing at Age 18-22:** There is a significant increase in billing amounts for patients aged 18-22, indicating higher medical expenses during this age group. This may be linked to common medical conditions emerging in young adulthood.
- **High Billing from Age 30 to 50:** Billing amounts stabilize but remain high between ages 30 to 50, possibly due to chronic conditions such as diabetes or hypertension becoming more prevalent during middle age.
- **Drop in Billing for Ages 86-89:** There is a sharp decline in billing amounts for patients aged 86-89, which could indicate reduced treatment frequency or less aggressive interventions for older patients.



11. **How would you identify which "Medical Conditions" are associated with the highest "Billing Amount" across hospitals?**

Ans) The analysis had the below mentioned insights and recommendation:

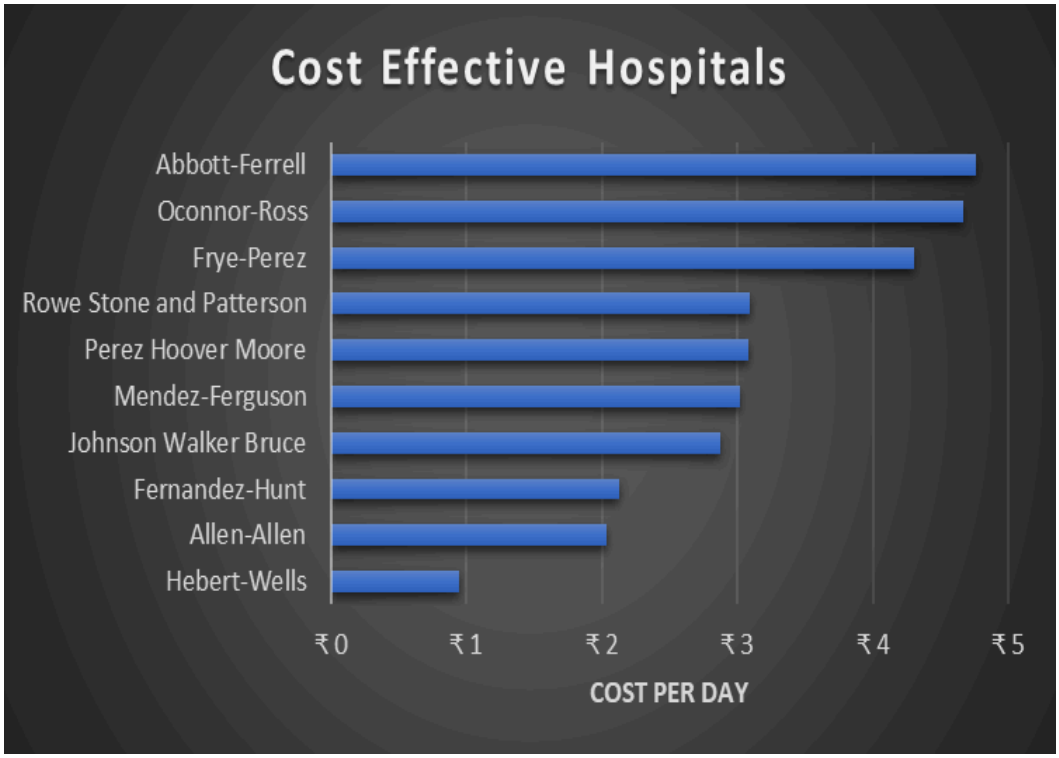
- **High Costs for Diabetes and Obesity:** Diabetes and Obesity incur the highest total billing amounts, making them the most costly medical conditions.
- **Arthritis and Hypertension:** These conditions also contribute significantly to total hospital costs, following closely behind diabetes and obesity.
- **Cancer Treatment Costs:** Cancer treatment, while still costly, has a slightly lower total billing amount compared to other chronic conditions, suggesting differences in treatment frequency or cost structure.



12. **How would you assess which hospitals have the highest efficiency based on patient length of stay and billing amounts?**

Ans) The analysis had the below mentioned insights and recommendation:

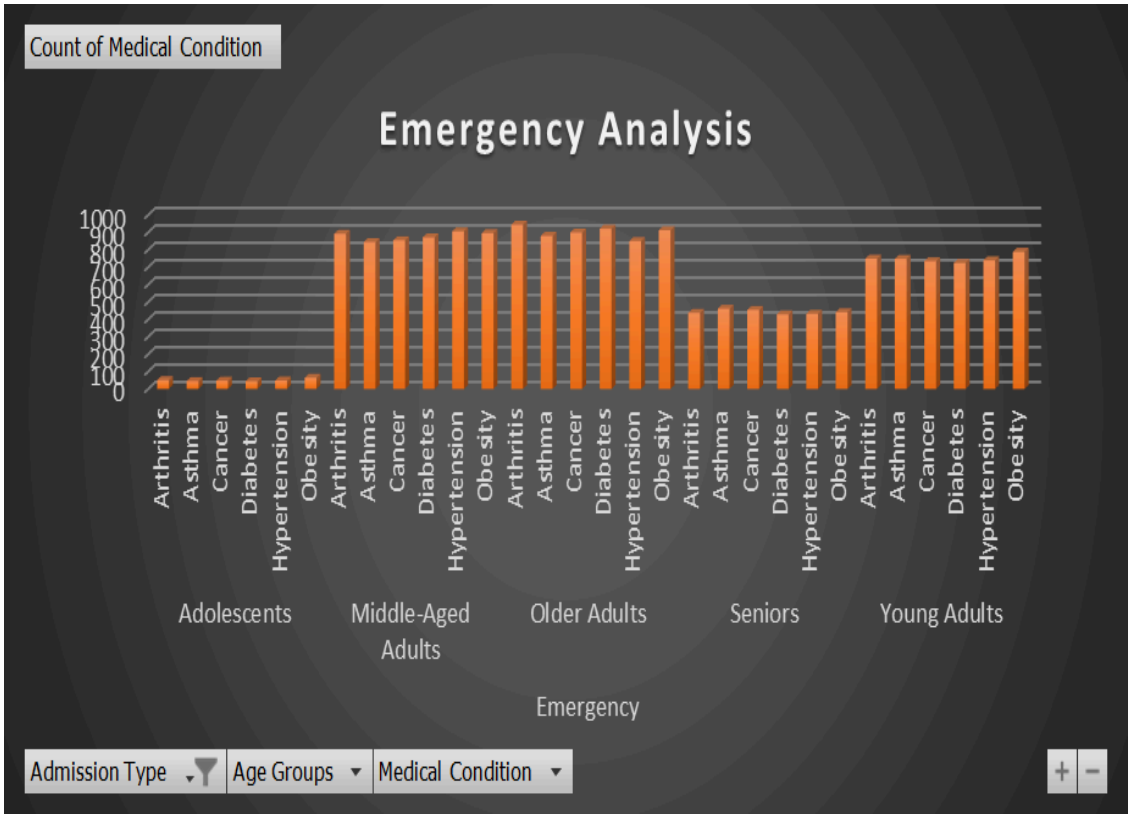
- **Low-Cost Efficiency:** Hebert-Wells has the lowest cost per day, indicating efficient resource use despite potentially longer patient stays. This suggests that the hospital manages its resources effectively, leading to minimal daily costs.
- **Mid-Range Costs:** Several hospitals, like Allen-Allen and Fernandez-Hunt, maintain moderate daily costs, balancing patient care quality with cost efficiency, which could be seen as a sustainable operational model.
- **High-Cost Hospitals:** Oconnor-Ross and Abbott-Ferrell incur the highest daily costs, indicating that there may be opportunities to optimize resource allocation or negotiate better pricing to reduce overall expenses while maintaining patient care quality.



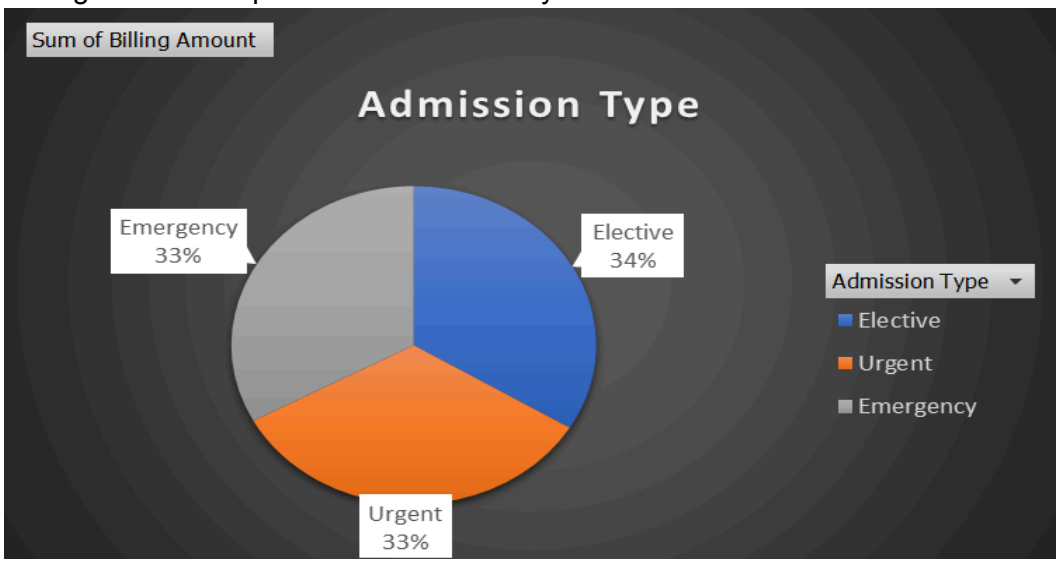
13. **What factors from this dataset would you analyze to determine patterns in "Emergency" admissions?**

Ans) The analysis had the below mentioned insights and recommendation:

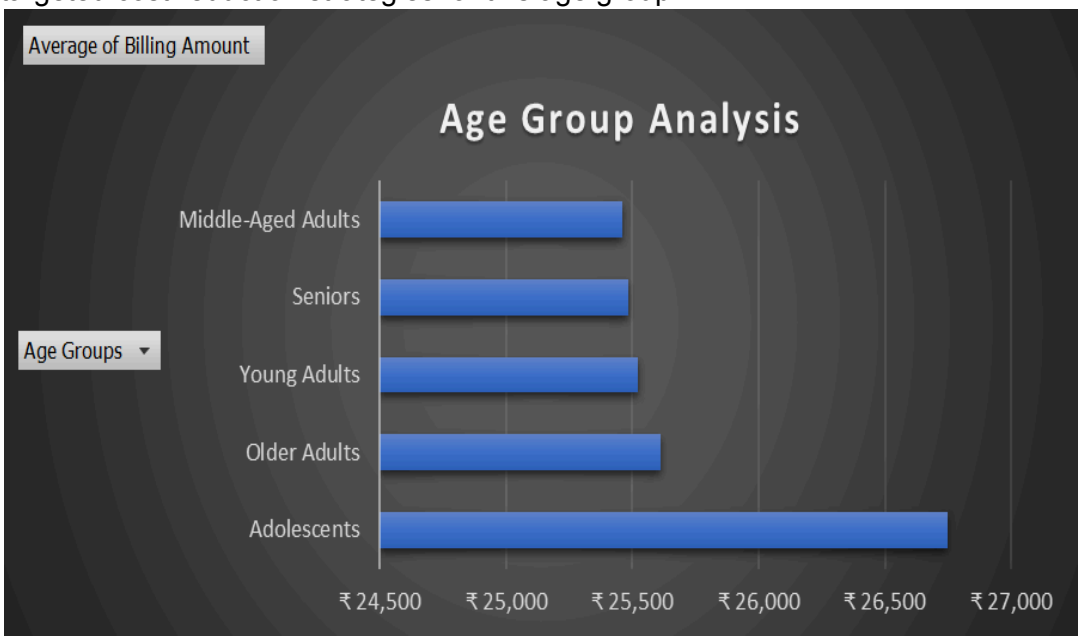
- **High Prevalence in Middle-Aged and Older Adults:** Middle-aged and older adults make up the largest portion of patients with chronic conditions like arthritis, asthma, cancer, and diabetes, indicating a focus on managing these age groups.
- **Emergency Cases Dominate:** Emergency admissions account for 18,102 cases, far surpassing specific medical conditions, highlighting the hospital's significant focus on acute care.
- **Chronic Conditions Impact Seniors:** Seniors have a high occurrence of chronic conditions like arthritis, asthma, and diabetes, emphasizing the need for specialized elderly care programs.



14. **Based on this dataset, how would you identify which "Admission Type" (Emergency, Elective, Urgent) is associated with higher costs?**
Ans) Billing amounts are relatively balanced across the three admission types: Elective (₹47.31 Cr), Urgent (₹46.92 Cr), and Emergency (₹46.17 Cr). This suggests that hospitals are handling a similar volume of billing for each admission type, indicating consistent demand across elective, urgent, and emergency care. Hospitals may benefit from allocating resources more evenly across these categories to ensure efficient patient management and optimize service delivery.

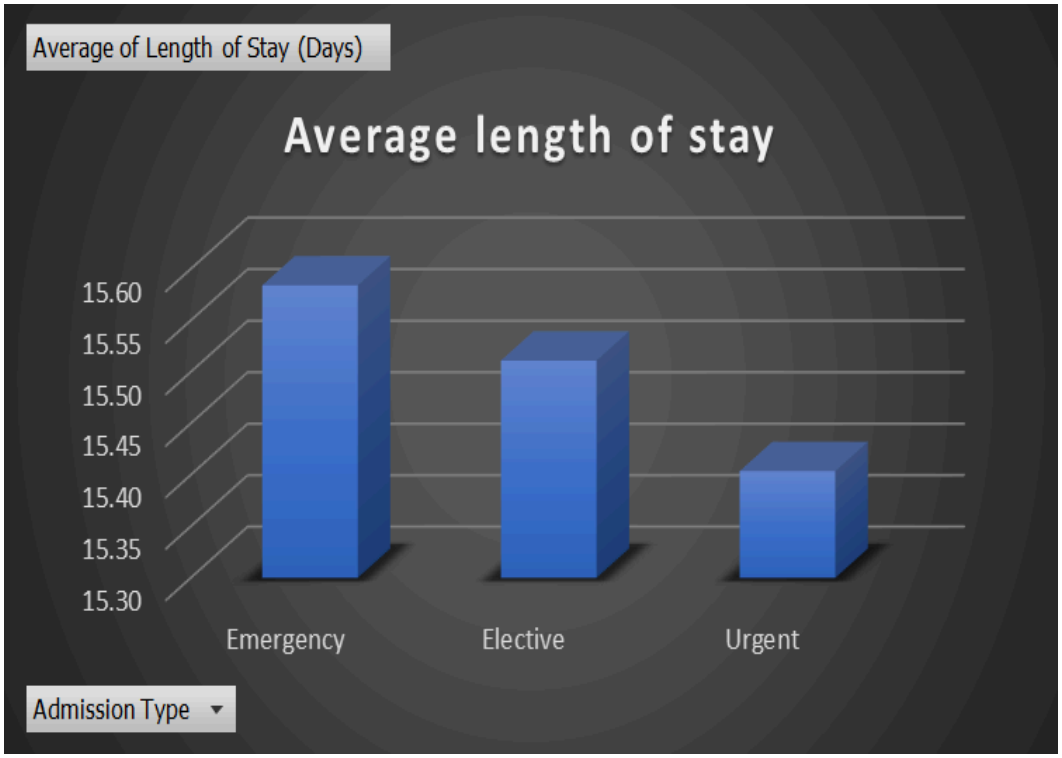


15. **What analysis would you conduct to determine if patient age influences the "Billing Amount" in this dataset?**
    Ans) The average billing amounts reveal that Adolescents have the highest average billing at ₹26,746, compared to other age groups. Older Adults follow closely at ₹25,612, while Young Adults, Seniors, and Middle-Aged Adults show similar billing amounts around ₹25,500. This indicates that hospitals may need to evaluate the services provided to Adolescents, as their costs are significantly higher, potentially leading to targeted cost-reduction strategies for this age group.



16. **What features would you focus on to optimize hospital resource allocation based on patient admissions and length of stay?**
    Ans) The average length of stay in hospitals is approximately 15.50 days, with Emergency admissions slightly higher at 15.58 days, followed closely by Elective admissions at 15.51 days. Urgent admissions have the shortest average stay at 15.40 days. This indicates that emergency cases may require more extended care, suggesting a need for resource allocation to address the complexities of emergency treatments.
    And,
    To optimize hospital resource allocation based on patient admissions and length of stay, I would focus on the following features:

    - **Admission Type**: Prioritize resources for Emergency cases, which have the longest average stay, to ensure adequate staffing and support.
    - **Length of Stay Trends**: Monitor trends in length of stay across different admission types to identify opportunities for reducing unnecessary extended stays and improving efficiency.


Average of Length of Stay (Days)
Average length of stay
15.60
15.55
15.50
15.45
15.40
15.35
15.30
Emergency
Elective
Urgent
Admission Type