**Learners have to develop a Report to support the answers to the following questions and suggestions.**

**Objective Questions:**

1. **In analyzing the hospital dataset with Power BI, ensure data cleaning to address inconsistencies and missing values before further analysis.**

**Steps to Clean Data in Power BI:**

**1. Remove Duplicate Rows:**

* Duplicate rows can occur during data import or due to system errors. These duplicates can skew the analysis.
* Action: Go to Power Query Editor → Select the table → Click on the Remove Duplicates option under the Transform tab.

**2. Handle Missing Values:**

* Missing values can affect the calculations and lead to incorrect results.
* Action: There are a few ways to deal with missing values:

Replace missing values: Replace NULL or missing values with meaningful values (e.g., "0", "Unknown", or the average of the column).

* Power Query Example: Use the Replace Values or Remove Missing options to replace or delete the missing data.

**3. Fix Data Types:**

* Ensure that each column is of the correct data type. For instance, a column that stores appointment fees should be a Currency type, while patient\_id should be an Integer.
* Action: Right-click on the column name → Select Change Type to set the correct data type.
* Example:
  + patient\_waittime should be of type Whole Number.
  + appointment\_fees should be Currency.

**4. Normalise Data:**

* Normalize values if needed to ensure consistency, especially for categorical data like departments or patient races.
* Action: Use the Transform tab to modify or split columns if necessary. For example, if the department column has inconsistent naming (e.g., "Gen Prac" and "General Practice"), standardize the names to a single format.

1. **Assess the Average Waiting Time:** **Analyse the patient wait times to identify the average duration a patient spends before receiving care.**  
     
   **Observation:**The Average Waiting Time of the Patients before receiving care is **35.25(minutes)**
2. **Visits by Department Referral:** **Calculate the total number of visits to each department based on referrals to understand which departments are most frequently visited.**

|  |  |
| --- | --- |
| **Department** | **No. of Visits** |
| Cardiology | 248 |
| Gastroenterology | 178 |
| General Practice | 7240 |
| Neurology | 193 |
| Orthopedics | 995 |
| Physiotherapy | 276 |
| Renal | 86 |

**Observation:**

🡪 The above list is the No. of Patient Visits for Each Department.   
🡪 We can observe that the “General Practice” Department has the highest No. of Visits.   
🡪 The “Renal” Department has the lowest No. of Visits.

1. **Patient Visits by Age Group: Segregate patient visits according to different age groups to see which demographics utilize healthcare services the most.**

|  |  |
| --- | --- |
| **Age Groups** | **No. of Visits** |
| 1-10 | 1176 |
| 11-20 | 1160 |
| 21-30 | 1207 |
| 31-40 | 1191 |
| 41-50 | 1137 |
| 51-60 | 1147 |
| 61-70 | 1150 |
| 71-80 | 1048 |
| **Grand Total** | **9216** |

**Observation:**- -> The above list is the distribution of Visits among the Age groups starting from 1-10 to 71-80.   
- -> Almost all the age groups have almost the same number of visits.

- -> From those age groups, the 21-30 age groups are having high numbers of visits.

- -> The 71-80 age group are having fewer visits compared to other age groups.

1. **Were there any Null values in the data? What would be the best way to handle these Null values and which approach have you opted for?**

**Observation:**  
Yes, there are null values in the “patient\_sat\_score” column of the “Hospital ER Table”.   
I Replaced Null values with the mean of the Total column.

**Approach**:

* The Best way to handle null values is based on the data set we need to handle the null values.
* If we have Null values in the String Column, then we can change it to “N/A”.
* If we have Null values in the Numerical Column, then we can change to the “Mean”, “Mode”, and “Median” of the entire column.
* Suppose we have Null Values in the Numerical Column, but the Column has like marks, Employee Salary or Revenue, etc.; in that case, we shouldn’t use Mean, Mode or Median. We need to replace it with “N/A”
* In this data set**,** the“patient\_sat\_score” column of the “Hospital ER Table” has Null values because it is the Satisfaction Score of the Patients. I replaced the Null values of the column with the Average (Mean) of the Entire Column.

1. **Is there any relation between the number of visits and the Gender of the patients?**

|  |  |
| --- | --- |
| **Gender** | **No. Of Visits** |
| F | 4487 |
| M | 4705 |
| NC | 24 |
| **Grand Total** | **9216** |

**Observation:**

* Yes, there is a relationship between the number of visits and the Gender of the patients.
* For the Male Gender, the No. of visits is 4705 – Highest.
* For the Female Gender, the No. of visits is 4487.
* For NC Gender, the No. of visits is 24 – Lowest.
* Compared to females, Males have the highest visits.

1. **Average Satisfaction by Demographics: Determine the relationship between patient satisfaction scores, their age groups, and racial backgrounds to pinpoint areas for improvement in patient experience.**

|  |  |
| --- | --- |
| **Age Group** | **Average of patient\_sat\_score** |
| 1-10 | 5.121212121 |
| 11-20 | 4.880136986 |
| 21-30 | 5.094674556 |
| 31-40 | 4.988023952 |
| 41-50 | 5.147435897 |
| 51-60 | 5.071895425 |
| 61-70 | 5.058441558 |
| 71-80 | 4.531986532 |

**Observation:**

* From the above table we can observe that the relationship between the Age groups and Satisfaction Score of the Patient.
* For the Age Group of “41-50” we have the Highest Satisfaction Score of the Patient.
* For the Age Group of “71-50” we have the Lowest Satisfaction Score of the Patient.

|  |  |
| --- | --- |
| **Demographics** | **Average of patient\_sat\_score** |
| African American | 5.070038911 |
| Asian | 5.010238908 |
| Declined to Identify | 4.970909091 |
| Native American/Alaska Native | 5.123188406 |
| Pacific Islander | 5.326530612 |
| Two or More Races | 4.834134615 |
| White | 4.935967302 |

**Observation:**

* From the above graph, we can observe the relationship between the Demographics Race and Satisfaction Score of the Patient.
* For the Demographics Race of “Pacific Islander”, we have the Highest Satisfaction Score of the patients.
* For the Age Demographics Race of “Two or More Races” we have the Lowest Satisfaction Score of the Patient.

1. **The hospital's managing director seeks to evaluate the revenue of each department to understand how much revenue is generated by each.**

|  |  |
| --- | --- |
| **Department** | **Total Revenue** |
| Orthopedics | 173636273 |
| General Practice | 167690816 |
| Neurology | 73085252 |
| Cardiology | 68667850 |
| Physiotherapy | 16868824 |
| Gastroenterology | 9907935 |
| Renal | 4799367 |
| Grand Total | 514656317 |

**Observation:**

* From the above graph we can observe the Revenue for each Department.
* The Department of “Orthopedics” has the Highest Revenue compared to all the Departments of the Hospital.
* The Department of “Renal” has the Lowest Revenue compared to all the Departments of the Hospital.

1. **Which department is charging the highest appointment fees in general? Use an aggregation DAX function to solve this question.**

Highest\_Department =

VAR DepartmentTable =

    SUMMARIZE(

        'Doctor-Patient Data',

        'Doctor-Patient Data'[department\_referral],

        "Average\_fees", AVERAGE('Doctor-Patient Data'[Appointment Fees])

    )

VAR TopDepartment =

    TOPN(1, DepartmentTable, [Average\_fees], DESC)

RETURN

    SELECTCOLUMNS(TopDepartment,"Department",'Doctor-Patient Data'[department\_referral])

**Output:**

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* The Neurology Department charges the highest appointment fees compared to all the departments.

1. **Create a tabular visualization in the Report view which consists of Month-wise total visits in the hospital.  Add a third column in the table that consists of the previous month’s total visits for each month’s row. Also, include a column that states whether the visits in a month are greater than that of the previous month's visits.**

**Approach:**

* Firstly, I extracted the Year and month from the date column.   
  **Year\_Month= FORMAT('Hospital ER'[date],"YYYY-MM")**
* In the second step, I created the measure of the previous month count or no. of visits of the patient. By using the query below:

**Prev month = calculate(count('Doctor-Patient Data'[patient\_id]), previousmonth('Hospital ER'[Year\_Month]))**

* In the third step, I created another measure for comparing the current month and previous month visits of the patients count. By using “IF” Dax, if the count of the current month's patients is greater than the previous month's, then the output is “Greater” or else it is “Less”. By using the query below:  
  **visit comparison = if(count('Doctor-Patient Data'[patient\_id])>[Prev Month], "Greater", "Less")**
* These above steps give the output, which consists of month-wise visits, Previous month visits and Visit Comparison.

**Output:**

**A screenshot of a data

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1. **Using ‘Calculate’ and a row iteration DAX function calculate the total number of patients who have visited Dr. Smith.**  
     
   **DAX QUERY:**  
   Smith patient visits count =  
   CALCULATE (COUNT ('Doctor-Patient Data'[Doctor Name]),'Doctor-Patient Data'[Doctor Name] ="Dr. Smith")

**Output:**

A number with black text

AI-generated content may be incorrect.  
**Observation:**The total no. of patient visits to the Doctor “Dr. Smith” is 5986.

1. **Calculate the average age of the patients who visit the Orthopedics department. Will the approach used to calculate this metric be different if the requirement had been all departments’ average age?**

* **Approach:**  
  For calculating the average age of the patients who visit the Orthopedics Department, I used the Below DAX Query.  
    
  Average age of ortho =   
  **CALCULATE(AVERAGE('Hospital ER'[patient\_age]),'Hospital ER'[department\_referral] = "Orthopedics")**  
    
  For calculating the Average age of the patients for all the Departments. I can simple use Table Visualization, and then I can drag and drop the Departments and Patients age.  
  Then, I can change the Summation into Average in order to get the Patients' average age across all Departments.

**Output:  
A number with black text

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**A screenshot of a medical survey

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Observation:**1. The average age of the patients who visit the Orthopedics Department is 38.66.

2. You can also see that I had attached the Department-Wise Average Age.

1. **Were there any data format issues in the data, and if there were/are how you handle them?**  
     
   **Observation:**There is no data format issues in the given data.   
   If any data format issues are present, then we can act according scenarios below:  
   **1. Data Type Mismatch** → Convert in Power Query (Transform Data → Change Data Type)  
   **2. Incorrect Date Format** → Change to Date/DateTime in Power Query **3. Blank/Null Values** → Replace in Power Query (Replace Values)  
   **4. Remove Duplicates** → Power Query → Remove Duplicates.  
   **5. Trim Extra Spaces** → Power Query → Format → Trim  
   **6. Split/Merge Columns** → Power Query → Split Column / Merge Columns.
2. **When we add a column in Power Query what’s the code that comes in M language in the formula bar? What do you know about M-query?**

**M-Query:**M Query is a powerful tool used in Power Query Editor to perform data extraction and transformation before the data is loaded into Power BI for further analysis. M is used to perform complex transformations, like merging tables, filtering data, creating custom columns, changing data types, and more.

**Key Features of M Query:**

1. **Functional Language:** M is a functional programming language, meaning that it processes inputs and produces outputs without side effects.
2. **Step-by-Step Data Transformation**: Every transformation you make in Power Query (filtering, grouping, merging, adding columns, etc.) generates an M step. These steps are tracked and can be edited at any time.
3. **Rich Functionality:** M includes a wide variety of functions to handle different data transformation tasks, including string manipulation, date/time calculations, mathematical operations, and more.
4. **Reusability:** M code can be reused across different queries, helping you maintain consistency across your data transformation steps.
5. **Support for Complex Operations:** You can create more sophisticated transformations that combine multiple operations into a single formula, like if-else statements, loops, and error handling.

**Power Query**

I have added a revenue column to the doctor-patient data in Power Query. It is Custom Column to get revenue I have added total bill of the patient column and appointment fees column. So, in formula bar in M- language I have got this below query:

**= Table.AddColumn(#"Changed Type", "Revenue", each [Appointment Fees] + [Total Bill])**

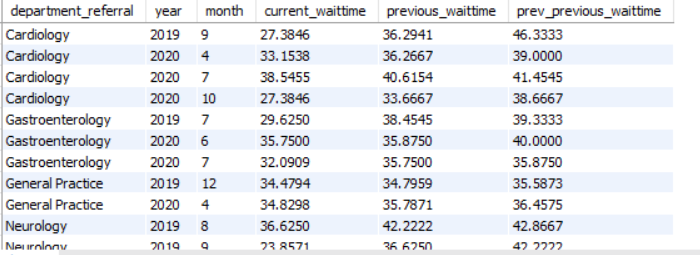
1. **Identify the top 5 doctors who generated the most revenue but had the fewest patients. (SQL)**  
   **QUERY:**select doctor\_name, sum(total\_bill) as total\_revenue, count(distinct patient\_id) as patientscount from doctor\_patients\_data  
   group by doctor\_name  
   order by total\_revenue desc, patientscount asc  
   limit 5;  
     
   **OUTPUT:  
   A screenshot of a computer

   AI-generated content may be incorrect.  
     
   OBSERVATION:**These above list is the Top 5 doctors who generated the most revenue among the all the doctors.
2. **Find the department where the average waiting time has decreased over three consecutive months. (SQL)**

**SQL QUERY:**WITH MonthlyAverage AS (  
 SELECT   
 department\_referral,  
 YEAR(date) AS year,  
 MONTH(date) AS month,  
 AVG(patient\_waittime) AS avg\_waittime  
 FROM hospital  
 GROUP BY department\_referral, YEAR(date), MONTH(date)  
 ),

ConsecutiveDecrease AS (  
SELECT   
a.department\_referral,  
 a.year,  
 a.month,  
 a.avg\_waittime AS current\_avg,  
 b.avg\_waittime AS previous\_avg,  
 c.avg\_waittime AS prev\_previous\_avg  
 FROM MonthlyAverage a  
JOIN MonthlyAverage b ON a.department\_referral = b.department\_referral  
AND a.year = b.year  
AND a.month = b.month + 1  
JOIN MonthlyAverage c ON b.department\_referral = c.department\_referral  
AND b.year = c.year  
AND b.month = c.month + 1  
)

SELECT   
department\_referral,  
year,  
month,  
current\_avg AS current\_waittime,   
previous\_avg AS previous\_waittime,   
prev\_previous\_avg AS prev\_previous\_waittime  
FROM ConsecutiveDecrease  
WHERE current\_avg < previous\_avg  
AND previous\_avg < prev\_previous\_avg  
ORDER BY department\_referral, year, month;

**OUTPUT:  
  
  
Observation:**These are the departments and year, month where the average waiting time has decreased over three consecutive months.

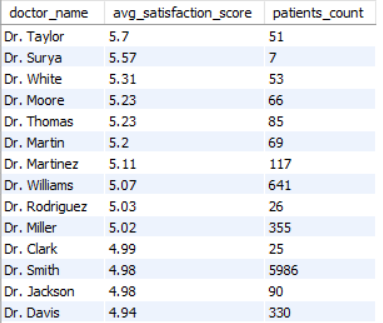
1. **Determine the ratio of male to female patients for each doctor and rank the doctors based on this ratio. (SQL)**  
     
   **SQL QUERY:**with cte as(  
   select d.doctor\_name,  
   sum(case when h.patient\_gender = "M" then 1 else 0 end) as male\_ratio,  
   sum(case when h.patient\_gender = "F" then 1 else 0 end) as female\_ratio,  
   (SUM(CASE WHEN h.patient\_gender = 'M' THEN 1 ELSE 0 END) /   
   SUM(CASE WHEN h.patient\_gender = 'F' THEN 1 ELSE 0 END)) as male\_to\_female\_ratio  
   from doctor\_patients\_data d  
   join   
   hospital h  
   on d.patient\_id = h.patient\_id  
   group by d.doctor\_name  
   )   
   select \*, dense\_rank() over(order by male\_to\_female\_ratio desc) as rnk from cte;

**Output:  
A screenshot of a table

AI-generated content may be incorrect.**

1. **Calculate the average satisfaction score of patients for each doctor based on their visits. (SQL)**  
     
   **SQL QUERY:**select d.doctor\_name, round(avg(h.patient\_sat\_score),2) as avg\_satisfaction\_score, count(d.patient\_id) as patients\_count  
   from doctor\_patients\_data d  
   join   
   hospital h   
   on d.patient\_id = h.patient\_id   
   group by d.doctor\_name  
   order by avg\_satisfaction\_score desc;

**Output:**



|  |  |  |
| --- | --- | --- |
| **doctor\_name** | **avg\_satisfaction\_score** | **patients\_count** |
| Dr. Taylor | 5.7 | 51 |
| Dr. Surya | 5.57 | 7 |
| Dr. White | 5.31 | 53 |
| Dr. Moore | 5.23 | 66 |
| Dr. Thomas | 5.23 | 85 |
| Dr. Martin | 5.2 | 69 |
| Dr. Martinez | 5.11 | 117 |
| Dr. Williams | 5.07 | 641 |
| Dr. Rodriguez | 5.03 | 26 |
| Dr. Miller | 5.02 | 355 |
| Dr. Clark | 4.99 | 25 |
| Dr. Smith | 4.98 | 5986 |
| Dr. Jackson | 4.98 | 90 |
| Dr. Davis | 4.94 | 330 |
| Dr. Thompson | 4.94 | 79 |
| Dr. Johnson | 4.93 | 613 |
| Dr. Brown | 4.89 | 309 |
| Dr. Anderson | 4.87 | 73 |
| Dr. Wilson | 4.84 | 60 |
| Dr. Garcia | 4.79 | 75 |
| Dr. Harris | 4.77 | 71 |
| Dr. Robinson | 4.68 | 35 |

1. **Find doctors who have treated patients from different races and calculate the diversity of their patient base. (SQL)**  
     
   **SQL Query:**select d.doctor\_name, h.patient\_race, count(d.patient\_id) as patient\_count

from doctor\_patients\_data d

join

hospital h

on d.patient\_id = h.patient\_id

group by d.doctor\_name,h.patient\_race

order by d.doctor\_name, h.patient\_race;

**Output:**  
A screenshot of a medical report

AI-generated content may be incorrect.

1. **Calculate the ratio of total bills generated by male patients to female patients for each department. (SQL)**  
     
   **SQL Query:**select d.department\_referral,

sum(case when h.patient\_gender= "M" then d.total\_bill else 0 end ) as total\_fees\_Male,

sum(case when h.patient\_gender= "F" then d.total\_bill else 0 end ) as total\_fees\_Female,

(sum(case when h.patient\_gender= "M" then d.total\_bill else 0 end ) / sum(case when h.patient\_gender= "F" then d.total\_bill else 0 end ) )

as ratio\_M\_TO\_F

from doctor\_patients\_data d

join

hospital h

on d.patient\_id = h.patient\_id

group by d.department\_referral

order by ratio\_M\_TO\_F desc;  
  
**Output:  
A screenshot of a computer

AI-generated content may be incorrect.**

|  |  |  |  |
| --- | --- | --- | --- |
| **department\_referral** | **total\_fees\_Male** | **total\_fees\_Female** | **ratio\_M\_TO\_F** |
| Orthopedics | 93724617 | 78583748 | 1.1927 |
| Cardiology | 35871380 | 32498870 | 1.1038 |
| Renal | 2453447 | 2302920 | 1.0654 |
| General Practice | 83732220 | 79910515 | 1.0478 |
| Physiotherapy | 8277601 | 8315223 | 0.9955 |
| Neurology | 35674678 | 37121074 | 0.961 |
| Gastroenterology | 4172088 | 5559024 | 0.7505 |

1. **Update the patient satisfaction score for all patients who visited the "General Practice" department and had a waiting time of more than 30 minutes. Increase their satisfaction score by 2 points, but ensure that the satisfaction score does not exceed 10. (SQL)**  
   **SQL Query:**  
     
   update hospital

set patient\_sat\_score =

case when patient\_sat\_score+2 > 10 then 10

else patient\_sat\_score+2

end

where patient\_waittime > 30 and department\_referral = "General Practice";

**Subjective Questions**

1. **What is the relation between patient wait time and satisfaction scores?**  
     
    **Insight:**We can observe that from the above graph **:**-> When the Waiting time is 10-34 minutes then the average satisfaction score is 5.50 and ->When the Waiting time is 35-60 minutes then the average satisfaction score is 4.94  
   In this case, when the patient's waiting time increases, the average satisfaction score decreases and when the patient's waiting time decreases, the average satisfaction score increases.  
     
   So, the relation between patient wait time and satisfaction scores is inversely proportional to each other.  
    **Recommendation:  
   Implement an Efficient Triage System:**

* Prioritize patients based on the urgency of their condition, ensuring that critical cases are treated immediately, while less urgent patients wait for shorter periods.
* Use a triage nurse or an automated system to quickly assess patients' needs as soon as they arrive.

**Optimize Scheduling:**

* Analyse historical data to understand peak times and adjust staff schedules, accordingly, ensuring more resources are available during high-demand periods.
* Implement time-slot-based appointments to prevent overbooking and spread out patient visits more evenly.

**Increase Staff Efficiency and Training**:

* Train staff on quick decision-making and efficient procedures to speed up patient processing.
* Use technology like mobile devices for quick data entry and access to patient records, reducing administrative delays.  
    
  **Improve Patient Flow Management**:
* Use patient flow management systems to track patient progress through the hospital, ensuring that patients don’t remain idle in one area for too long.
* Ensure clear signage and staffcommunication to guide patients efficiently from check-in to treatment.

**Improve Communication**:

* Ensure that patients are informed about waiting times and any delays. Real**-**timestatusupdates can help manage expectations and reduce frustration.
* Use automated alerts or a hospital app to keep patients updated on their appointment status or estimated wait times.

**Personalized Patient Care**:

* Train staff to provide a more personalized and empathetic approach to patient care. Knowing that their concerns are heard and addressed positively impacts overall satisfaction.
* Assign patient liaisons who can assist patients and their families during their wait, providing updates or answering questions.

**Enhance the Waiting Area**:

* Improve the comfort and ambience of the waiting area (e.g., comfortable seating, soothing environment, entertainment like TV, or free Wi-Fi).
* If possible, provide pain relief or comfort options to patients while they wait, particularly in areas where wait times may be longer (e.g., emergency departments).  
    
  **Monitor and Address Complaints**:
* Track and address patient complaints quickly, using a dedicated system or team to resolve issues promptly. Ensuring that patients feel heard and that their concerns are addressed in a timely manner helps improve satisfaction.

1. **How do patient demographics affect the frequency of visits to different departments?  
     
   Approach:**I categorised the demographics in our given data into 3 based on Race, Age and Gender.  
     
     
     
     
     
     
     
   **Insights:  
   Gender Distribution:**

* The majority of patients are male (4705), while there are 4487 females. However, the distribution is relatively balanced.
* The General Practice department has the highest number of visits from both male and female patients.

**Race and Ethnicity Distribution:**

* Orthopaedics and Physiotherapy are more popular among White patients, while General Practice sees a diverse racial distribution, with high visits from African Americans and Two or More Races.
* The General Practice department has the highest number of visits across all races, with African American (1951) and White (2571) patients having the highest frequency of visits.

**Age Distribution:**

* The 1-10 age group has the highest number of visits, particularly in the General Practice department (919 visits). This indicates that children are more frequent visitors to this department.
* Older patients (age group 51-60 and 61-70) show more frequent visits to General Practice, Orthopaedics, and Physiotherapy, which suggests these departments may treat chronic conditions or preventative care for ageing patients.

**Total Visits by Department:**

* General Practice has the highest visit count, with 7240 visits recorded. It is followed by Orthopedics (995) and Physiotherapy (276), suggesting that general health checks and consultations are more popular than specialized treatments.
* Specialized Departments like Cardiology (248), Neurology (193), Gastroenterology (178), and Renal (86) have lower patient visit counts, indicating either a more specialized nature or fewer people needing these services.

**Recommendations:**

**1. Focus on High-Volume Departments (General Practice and Orthopaedics):**

* Since General Practice has the highest volume of visits, the hospital could consider adding more doctors or extending hours to meet the high demand.
* Optimize Orthopaedics Services: There are a significant number of visits to Orthopaedics. The hospital could expand these services to meet the demand for joint replacements, sports injuries, and arthritis management.

**2. Target Specialized Care for Older Age Groups:**

* Given the higher visits among the 31-40 age groups, particularly in General Practice, Orthopaedics, and Physiotherapy, the hospital could consider creating more targeted geriatric services to meet the needs of ageing patients, including chronic disease management and rehabilitation programs.

**3. Improve Services for Race Groups with Lower Visit Frequency:**

* The hospital can investigate why departments like Gastroenterology, Renal, and Neurology have fewer visits from certain ethnic groups (e.g., African American or Asian). They may need to tailor communication strategies to better reach underrated communities.

**4. Age-Specific Services:**

* For the younger age group (1-10): Expand paediatric care services in General Practice and other departments focusing on child health to meet their unique needs, including vaccination programs and health education.
* Tailor services to address age-specific needs like geriatric care, chronic disease management, and physical rehabilitation.

**5. Gender-Specific Approaches:**

* Women’s health services: Given that the hospital sees a large number of female patients, more emphasis could be placed on services like obstetrics and gynaecology, breast cancer awareness, and mental health support.
* Men’s health services: For the male demographic, cardiovascular health, urology, and orthopaedics could be key areas of growth.

**6. Enhance Data Collection:**

* The hospital could improve its data collection methods, especially for NC (Not Classified) categories, to ensure all patient demographics are well-represented in reports and analytics.

1. **Is there a noticeable trend in the volume of patient visits throughout the year?**  
     
     
     
     
     
   **Insight:**

* From the above graphs, we can observe that for the year 2019, the count of patients is 4338, and for the year 2020 the count of patients is 4878.
* This represents a 13% increase in patient visits from 2019 to 2020.
* From this, we can say that the count of patients is increasing yearly.
* I also Forecasted that next year's count of patients will be approximately 5418.

**Recommendations:  
  
Maintain Growth by Expanding Services:**

* Given the growth in patient visits in 2020, the hospital should consider expanding its capacity, especially in high-demand departments like General Practice, Orthopedics, and Pediatrics.
* The hospital could add more medical professionals, increase hours of operation, or even add additional clinics to accommodate the growing number of patients.

**Focus on Retaining and Engaging Patients:**

* With the increase in patient visits, the hospital should focus on retaining and engaging these patients to prevent them from seeking treatment elsewhere.
* Loyalty programs, regular check-up reminders, and personalized care are key strategies that can help retain patients in the long term.

**Monitor and Optimize Resource Allocation:**

* With the increase in patient visits, the hospital should continuously monitor the demand in different departments and adjust resources accordingly. This includes optimizing staffing levels, managing waiting times, and maintaining efficient scheduling.
* The hospital could also improve marketing strategies to reach more patients. For instance, promoting health packages, preventive health checkups, or new treatment options can attract more patients and improve the hospital’s image.

1. **Which age groups report the highest and lowest satisfaction scores?  
     
     
     
   Insights:  
   Highest Satisfaction Score:**

* Age Group 41-50 reports the highest average patient satisfaction score of 5.15.
* This age group is likely receiving better healthcare experiences compared to others.

**Lowest Satisfaction Score:**

* Age Group 71-80 reports the lowest average patient satisfaction score of 4.53.
* This may indicate potential issues with the hospital’s service for older patients, who could face different healthcare needs and challenges.

**Recommendations:**

**Improve Patient Experience for the Elderly Patients (71-80):**

* Ensure better communication to the Elderly Patients, including involving family members in care decisions.
* Make sure the hospital is accessible to elderly patients, considering mobility aids, transportation, and room comfort.
* Training staff to cater to older patient's unique needs.

**Focus on Engagement with Younger Patients (11-20 years):**

* Providing age-appropriate health education and interactive tools to engage young patients.
* Offering mental health support and guidance, as this age group might experience stress or anxiety.
* Including specialized care for issues prevalent in this group, such as reproductive health and sports injuries.

**Target Communication and Care for the Middle-Aged (31-60):**

* Middle-aged adults may have work-related health concerns.
* Family care services, as many individuals in this age group manage the health needs of children and ageing parents.

**Personalize Services Based on Age Group Needs:**

* Offer age-targeted educational programs on health, diet, and wellness.
* Design interactive and engaging hospital experiences for younger patients, while focusing on comfort and support for elderly patients.

**Regular Feedback and Monitoring:**

* Set up regular patient satisfaction surveys to track these changes, and focus on areas where satisfaction is below average, especially for older adults and adolescents.

1. **Say someone outside of the hospital claims that there is racial or gender-based discrimination in the hospital, how will you identify whether the claim was right or not?  
     
   Approach:**

**Analyse Patient Demographics and Department Visits Pattern:**

* Review the distribution of visits across different departments based on race and gender. If certain racial or gender groups are disproportionately underrepresented or overrepresented in particular departments, it might indicate potential biases in treatment or accessibility.
* Compare wait times and appointment availability between groups.
* Note any racial/gender disparities.
* Break down average satisfaction, service use, and care quality by race/gender.

**Evaluate Patient Satisfaction and Feedback:**

* Analyse patient satisfaction scores across different racial and gender groups. Disparities in satisfaction scores between groups might point to the possibility of unequal treatment.
* If available, conduct patient surveys focused on experiences related to racial or gender-based treatment. Gather qualitative feedback on any experiences of discrimination.

**Investigate Hospital Policies and Practices:**

* Review the hospital’s staff training programs to ensure that anti-discrimination training is in place and that it covers issues related to race, gender, and other forms of discrimination.
* Evaluate whether the hospital has an accessible and transparent system for reporting complaints regarding discrimination or bias, and how effectively these complaints are addressed.

**Evaluate Hiring and Staff Behaviour:**

* Review the demographics of the hospital staff (doctors, nurses, administrative staff) and analyse if there are racial or gender imbalances. Bias in hiring or lack of diversity might be correlated with discriminatory behaviours.
* Conduct an audit of the hospital staff's behaviour and interactions with patients from different demographics. A pattern of unprofessional treatment or microaggressions may indicate racial or gender bias.

**Recommendations:**

**Diversity and Inclusion Training:**

* Implement mandatory training programs for all hospital staff to raise awareness of unconscious bias, racial and gender equality, and inclusive care practices. This should include cultural competency and sensitivity training.

**Monitor and Ensure Equal Access to Healthcare Services**:

* Ensure that all patients have equal access to appointments, treatments, and follow-up care, regardless of gender, race, or ethnicity. Implement processes that measure and track access to care across different demographic groups.

**Implement Transparent Reporting Systems**:

* Create a clear and accessible system for patients and staff to report discrimination or bias. Ensure that these reports are taken seriously and are acted upon promptly to investigate and resolve issues.

**Promote Diversity in Hiring**:

* Encourage diversity in recruitment for all hospital roles, especially in leadership positions, to reflect the diversity of the patient population. Diverse teams are more likely to offer fair and equitable care.

**Regular Audits:**

* Conduct regular audits on patient visits, treatment outcomes, and satisfaction surveys to identify any disparities. Use this data to continuously improve the hospital’s services and practices.

1. **The hospital management intends to offer discounts to patients. How should these offers/discounts be assigned to patients, on what basis, and why?**

**Approach & Recommendation:**

**Patient Demographics:**

* Elderly people of the Age group of 60 years and above need more healthcare and may face financial challenges, so offering discounts for senior citizens is a good way to attract them and ensure better healthcare access.
* **Recommendation:** Offer a discount percentage based on age, for example a 10-15 % discount for ages of 60+ years.
* Parents often face challenges paying for childcare. Discounts can be offered for children's healthcare services.
* **Recommendation:** Provide family-focused discounts or free health check-ups for children to encourage regular visits.
* Women may benefit from discounts for services that are related to women’s health (e.g., maternity care, gynaecology, breast cancer screenings).
* **Recommendation:** Provide discounts or offers tied to women's health initiatives (e.g., 10-20% off for maternity or preventive care screenings).

**Medical History and Current Condition:**

* Patients with chronic conditions like diabetes, hypertension, or heart disease are frequent visitors and could benefit from discounts, especially if they need regular monitoring and care.
* **Recommendation**: Offer chronic care discounts to encourage patients to stay on top of their treatment plans. This could be loyalty-based discounts or referral bonuses for ongoing treatments.
* Offering discounts on preventive care services like vaccinations, health checkups, and screenings is beneficial to encourage early diagnosis and prevention.
* **Recommendation:** Provide discounts on annual health check-ups for all patients, with increased discounts for high-risk patients.

**Frequency of Visits and Loyalty:**

* Loyal patients who have been visiting the hospital frequently can be rewarded with discounts as a form of appreciation and encouragement for their continued visits.
* **Recommendation:** Introduce loyalty programs that provide discounts to patients who have made multiple visits within a year or spent above a certain threshold in total bills.
* Referral discounts can be given to patients who refer friends or family to the hospital.
* **Recommendation:** Offer discounts on the next visit to patients who refer others. These can be in the form of % off on services or free consultations for the referred patient.

**Socioeconomic Status:**

* Offer discounts to patients who are financially unstable. This can be based on their insurance coverage, income level, or financial hardship.
* **Recommendation:** Offer a sliding scale discount based on income brackets or provide charity care discounts to ensure that low-income patients still have access to essential services.
* Partner with insurance companies to offer discounts to patients with certain insurance plans (e.g., certain government or nonprofit health plans).
* **Recommendation:** Offer insurance-specific discounts to patients who have low-tier or no insurance coverage. These could be payment plans or reduced co-pays.

**Early Payment Discounts:**

* To encourage patients to pay bills on time, the hospital can offer discounts for early payments or full upfront payments.
* **Recommendation:** Provide a 5-10% discount for patients who pay for their treatment in full before the service or immediately post-treatment.

**Health Awareness Campaigns:**

* Discounts can be tied to special awareness months, such as Breast Cancer Awareness Month, Heart Health Month, etc.
* **Recommendation:** Offer promotional discounts during health awareness campaigns or special health check-up packages for specific conditions during these periods.

1. **The hospital has a budget to hire 2-3 new doctors. They have asked for your suggestions on which departments they should hire.**

**Insight:**

|  |  |
| --- | --- |
| **Department** | **Count of Doctors** |
| Cardiology | 3 |
| Gastroenterology | 4 |
| General Practice | 3 |
| Neurology | 3 |
| Orthopaedics | 4 |
| Physiotherapy | 4 |
| Renal | 3 |
| **Grand Total** | **22** |

|  |  |
| --- | --- |
| **Row Labels** | **Count of patient\_id** |
| Cardiology | 248 |
| Gastroenterology | 178 |
| General Practice | 7240 |
| Neurology | 193 |
| Orthopedics | 995 |
| Physiotherapy | 276 |
| Renal | 86 |
| **Grand Total** | **9216** |

**1. Doctor Distribution:**

* Cardiology: 3 doctors
* Gastroenterology: 4 doctors
* General Practice: 3 doctors
* Neurology: 3 doctors
* Orthopedics: 4 doctors
* Physiotherapy: 4 doctors
* Renal: 3 doctors
* Total: 24 doctors

**2. Patient Visits per Department:**

* General Practice: 7240 patients
* Orthopedics: 995 patients
* Cardiology: 248 patients
* Gastroenterology: 178 patients
* Physiotherapy: 276 patients
* Neurology: 193 patients
* Renal: 86 patients
* Total: 9216 patients

**Recommendation:**

* General Practice sees the highest number of patients (7240), but it only has 3 doctors, which suggests that the department is overburdened.
* This indicates a need for additional doctors in this department to handle the large patient load.
* Orthopaedics (995 patients) and Gastroenterology (178 patients) both have 4 doctors, but the number of patients is significantly lower compared to General Practice. This may indicate that more specialised doctors are required in General Practice, as it handles a higher volume of patients.
* Departments with Lower Patient Volume (e.g., Renal with 86 patients, Neurology with 193 patients) have only 3 doctors, which may mean these departments are adequately staffed, or they are not as frequently visited as others.

1. **Is the hospital profitable? How will you determine the profitability?**

**Insight:**

**A white sign with black text

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**Total Revenue of the Hospital**

* The Total Revenue of the Hospital is calculated by the sum of the total bills of the patients and the appointment fees of the doctor to the patients.
* This above summation gives us the Total Revenue of the Hospital.
* Sum of the Total Bills of the Patients = 509309117
* Sum of the Appointment Fees of the Doctors = 5347200
* Total Revenue of the Hospital = 509309117 + 5347200

=514656317

* The Total Revenue of the Hospital is approximately **515 million**.

**Profitability:**

* The Profitability of the Hospital can be determined by the Total Revenue of the Hospital subtracted by the Total Expenses of the Hospital
* The calculation of Profit Formula is   
  **Total Profit = Total Revenue of the Hospital – Total expenses of the Hospital**
* Expenses: Here, the Hospital Expenses are doctors ’ salaries, medical supplies, Electricity bill of the hospital, Utilities, Water supply, Hospital staff, Hospital workers
* This above thing comes under the Total Expenses of the Hospital.
* Unfortunately, we don’t have the data for the Expenses of the Hospital in our given data set.

**Profitability Ratios:**

* We can calculate the following ratios to measure the hospital's financial health:  
  Profit Margin:  
   **Profit Margin = (Profit / Total Revenue)​×100**
* This ratio indicates how much of the revenue is converted into profit. A higher profit margin means the hospital is more efficient in converting revenue into profit.

**Return on Assets (ROA)**: If asset data (like hospital equipment, building, etc.) is available, we can measure the hospital’s ability to generate profit from its assets.  
 **ROA = (Net Profit / Total Assets) \* 100**

**Return on Equity (ROE)**: If data on hospital ownership or equity is available, ROE can measure profitability relative to the equity invested in the hospital.

**ROE = (Net Profit / Shareholder Equity) \* 100**

1. **Any Department for which the waiting time is oddly large?**

**Insight:**

|  |  |
| --- | --- |
| **Department** | **Average of patient wait time** |
| Renal | 34.69767442 |
| Orthopedics | 34.98291457 |
| General Practice | 35.19640884 |
| Cardiology | 35.35483871 |
| Gastroenterology | 35.83146067 |
| Physiotherapy | 36.56521739 |
| Neurology | 36.80310881 |

* We can observe that the **“Neurology”** Department is having more waiting time than the other Departments.
* Followed by the “Physiotherapy Department is having next highest waiting time after Neurology Department.
* Other departments like General Practice, Cardiology, and Orthopedics have average wait times around 35 minutes, which is already somewhat high, especially in a hospital setting where long wait times could negatively impact patient satisfaction.

**Recommendation:**

**Increase Staffing for High Wait Time Departments:**

* Neurology and Physiotherapy should be prioritized for additional staffing or a review of workload distribution. Hiring more specialists or improving the efficiency of existing ones could help in reducing the waiting time.
* Consider adding more support staff (nurses or physician assistants) to assist with routine tasks, allowing doctors to focus more on consultations.

**Improve Patient Flow in Overburdened Departments**:

* In General Practice, where the volume of patients is likely high, consider implementing triage systems to prioritize patients based on the urgency of their needs.
* A more efficient appointment scheduling system (e.g., telemedicine or online booking options) could reduce congestion and waiting times in this department.

**Customer Experience and Communication:**

* To improve patient satisfaction despite longer waiting times, provide clear communication regarding wait times and any delays. Offering comfortable waiting areas and other patient engagement strategies can help mitigate frustration.
* A more transparent system (for example, through a mobile app or website) can give patients updates on waiting times and status.

1. **Come up with strategies to provide discounts to the patients.**

**Approach & Recommendation:**

**Patient Demographics:**

* Elderly people of the Age group of 60 years above need more healthcare and may face financial challenges, so offering discounts for senior citizens is a good way to attract them and ensure better healthcare access.
* **Recommendation:** Offer a discount percentage based on age for example a 10-15 % discount on ages of 60+ years.
* Parents often face challenges paying for childcare. Discounts can be offered for children's healthcare services.
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**Health Awareness Campaigns:**

* Discounts can be tied to special awareness months, such as Breast Cancer Awareness Month, Heart Health Month, etc.

**Recommendation:** Offer promotional discounts during health awareness campaigns or special health check-up packages for specific conditions during these periods.

1. **Say you need to align the doctors of the “General Practice” department to work in one of the two shifts, how will you identify what will these two shifts' timings be, and how will you divide the doctors in these two shifts? And also will this 2 shift policy be helpful for the hospital?**

**Approach:**

**Identify Peak Hours of Patient Visits:**

* Using the hospital's visit data, analyse the patient arrival times or appointments to identify periods with the highest patient volume.
* Look for patterns in terms of days and hours when appointments or consultations in General Practice are more frequent.

**Action Plan:**

* If the data includes time slots or patient visit timestamps, aggregate patient visits by hour or day part (morning vs. afternoon vs evening).
* Will divide the shifts into two parts:  
  Morning Shift (8 am to 3 pm) – This will cover the first half of the day.  
  Afternoon Shift (3 pm to 10 pm) – This will cover the second half of the day.

**Assign Doctors to the Shifts:**

* Ensure that each doctor’s availability is aligned with the shift timings. Some doctors may have preferences for morning or afternoon shifts.
* **Action Plan:**Check with Doctors to determine their preferred shifts.If preferences are balanced, randomly allocate doctors to shifts to ensure equal distribution. Alternatively, allocate doctors based on patient demand (e.g., assigning more experienced doctors during the busier shift).

**Balance Workload:**

* Ensure that the patient load is evenly distributed between the two shifts.
* Doctors in the morning shift might handle routine consultations, while afternoon doctors could manage follow-ups or complex cases.
* Use historical patient data to balance the workload, ensuring no shift becomes overloaded with patients.
* **Action Plan:**Ensure there is no staffing imbalance by considering the number of doctors required per shift based on patient visit patterns.

**Test and Adjust Shift Timing:**

* Before finalizing the shift system, run a pilot phase where doctors are assigned to the morning and afternoon shifts for a set period (e.g., 2 weeks).
* During this time, collect feedback from doctors regarding their workload and patient feedback regarding wait times and overall satisfaction.
* **Action plan:**Monitor patient waiting times and the doctor’s workload during the pilot phase.  
  Adjust shifts if one shift is found to be underutilized or overburdened.

**Benefits of the Two-Shift System:**

* The two-shift policy ensures that patients have more flexible access to doctors during the day, especially for working individuals who may not be able to visit during traditional office hours.
* This could help increase patient retention and attract new patients, particularly those looking for after-hours consultations.
* By distributing patient visits more evenly throughout the day, the hospital can minimize peak congestion. This will help reduce wait times, improving patient satisfaction.
* With two shifts, doctors can potentially handle more patients per day, which can help the hospital meet growing demand in the General Practice department without adding new staff.
* Doctors may benefit from a better work-life balance by having the option of choosing their preferred shifts, helping to reduce burnout and enhance overall job satisfaction.

1. **What do you understand by PowerBI gateway? What are its use cases?**

**PowerBI gateway:**A **Power BI Gateway** acts as a bridge between **on-premises data sources** (such as local databases, files, or data services) and the **Power BI service** in the cloud. It facilitates secure data transfer between the on-premises data and Power BI without moving the actual data to the cloud, ensuring that your data remains secure within your local infrastructure.

The Power BI Gateway enables seamless data refreshes and live connections, allowing Power BI reports and dashboards to stay up-to-date with the most recent data without requiring manual intervention.

**Types of Power BI Gateways:**

1. **Personal Gateway**:
   * Designed for individual use, this gateway is suitable for users who want to connect to personal or small-scale data sources (Excel, Access, etc.).
   * It supports scheduling refreshes for on-premises data but does not support real-time data access.
   * Best used for users who don’t need to share datasets with others.
2. **Enterprise Gateway**:
   * Suitable for larger organizations with multiple users and complex environments.
   * It supports real-time data connections and can handle multiple data sources, making it more scalable.
   * This gateway allows multiple users to use the same configuration for access to on-premises data sources.

**Use Cases of Power BI Gateway:**

1. **On-Premises Data Access**:
   * Organizations that store their data in local databases (such as SQL Server, Oracle, or other enterprise data sources) and do not want to migrate the data to the cloud can use the Power BI Gateway to connect Power BI with on-premises data sources. This ensures that real-time data or scheduled refreshes can still occur while the data remains behind the organization’s firewall.
2. **Hybrid Cloud Environments**:
   * In scenarios where some data is stored on-premises and other data is in the cloud (such as in a hybrid cloud model), the Power BI Gateway allows the merging and analysis of both data types in a single report or dashboard.
3. **Data Security and Compliance**:
   * For industries where data must remain on-premises for compliance reasons (e.g., financial institutions, healthcare, etc.), the Power BI Gateway ensures that sensitive data stays on local systems while allowing the organization to leverage cloud-based analytics in Power BI.
   * This meets data privacy and security regulations.
4. **Scheduled Data Refresh**:
   * If an organization wants to keep reports and dashboards updated on a regular basis (daily, weekly, etc.) but does not want to manually upload data each time, the scheduled refresh feature in the Power BI Gateway automatically updates the data at specified intervals.
5. **Real-Time Data Analysis**:
   * With live connections, organizations can monitor real-time data streams from on-premises sources directly in Power BI. This is useful for operations teams, monitoring performance metrics, or tracking events as they happen (e.g., real-time inventory management, financial transaction processing).
6. **Collaboration and Data Sharing**:
   * By using Power BI Gateway, organizations can securely share dashboards and reports with multiple users, even if the data sources are on-premises. The gateway ensures that multiple users can access up-to-date, relevant information for better collaboration.
7. **How would you approach this problem, if the objective and subjective questions weren't given?**

**Approach:**

* The first step would be to gain a clear understanding of the problem's context. What is the ultimate goal of the analysis or project? For example, if this is related to analysing data for a hospital, I would consider the objective as improving patient care, increasing hospital efficiency, optimizing department resource allocation, and increasing satisfaction of the patients.
* Without direct questions, it’s essential to define clear metrics that align with the hospital's goals. For instance, if the goal is to increase patient satisfaction, metrics like patient satisfaction scores, waiting times, appointment frequency, and number of visits per patient would be key indicators.
* Establish success criteria based on these metrics. For example, if the goal is to reduce patient waiting times, success could be measured by average wait time reduction.
* The next step is to examine the data available to me. This includes understanding the structure of the dataset, identifying which variables are available (e.g., patient demographics, appointment data, doctor information), and determining what analysis is possible with this data.
* For example, if I have data on appointment fees, patient wait times, satisfaction scores, and department referrals, I will explore how these variables correlate and contribute to overall patient experience and hospital performance.
* I would begin with an exploratory data analysis (EDA) to get an initial sense of the data. This involves:  
  **Summarizing the data**: Checking for missing values, data types, and distributions of key variables.

**Visualisations**: Creating visualisations (like histograms, bar charts, and scatter plots) to spot trends, correlations, and potential areas of concern or improvement.

**Descriptive statistics**: Calculating mean, median, standard deviation, and other relevant statistics to understand the central tendencies and variability in the data.

* I would analyse the relationship between key variables using techniques such as:  
  **Correlations**: Identifying which variables are related to others (e.g., whether a higher number of visits correlates with higher satisfaction).

**Group Comparisons**: Comparing departments, patient age groups, or genders to see how they differ in terms of wait times, satisfaction scores, or visit frequency.

**Trend Analysis**: Looking at how variables change over time, such as tracking the trend in patient satisfaction or wait times across different months or years.

* I would identify actionable insights based on the analysis. For example:  
  **Satisfaction Scores**: Identify which departments have lower satisfaction scores and suggest improvements in those areas.

**Operational Efficiency**: If wait times are consistently high in certain departments, I could recommend process improvements, additional staff, or changes in scheduling.

**Patient Segmentation**: If certain patient demographics (e.g., age, gender) tend to visit specific departments more frequently, I could suggest targeted marketing or specialized services.

* Based on the insights gathered, I would develop clear **recommendations** for the hospital to improve operations, patient satisfaction, or financial performance. This could include:  
  **Optimizing Scheduling**: If certain times of day are more crowded, the hospital could consider adjusting staffing or offering flexible hours.

**Personalized Marketing**: Based on patient demographics, personalized recommendations could be made to improve engagement with specific services or departments.

1. **Can you analyze and write the type of relationship between the doctor id and department, is it one-to-one?**

To determine the type of relationship between Doctor ID and Department, we need to analyse the data in terms of how these two entities are connected. Specifically, we want to establish whether the relationship is one-to-one, one-to-many, or many-to-many.  
  
**Analysing the Relationship Between Doctor ID and Department:**To assess the relationship, we need to look at the Doctor ID and the Department. Specifically, we want to check:

* How many distinct departments each doctor is associated with.  
  There are total 7 distinct departments are there

|  |
| --- |
| **Department** |
| **Cardiology** |
| **Gastroenterology** |
| **General Practice** |
| **Neurology** |
| **Orthopedics** |
| **Physiotherapy** |
| **Renal** |

* How many doctors each department has.  
  There are total 22 doctors are present in the hospital. In that there are multiple doctors are there in each department. The data is below:  
   A screenshot of a medical survey

  AI-generated content may be incorrect.

**One-to-Many Relationship**:

* A doctor is assigned to one department, but the department has multiple doctors.
* Example:
  + **Doctor A** → **General Practice**
  + **Doctor B** → **General Practice**
  + **Doctor C** → **General Practice**

**Conclusion:**The relationship between Doctor ID and Department is typically **one-to-many**. This is because a single doctor usually works in one department, but multiple doctors are working to the same department.

**Report**

The hospital has asked for a report with three tabs:

* Main Tab
* Doctors’ Tab
* Patients’ Tab

* **Using the Main tab in the report,** the hospital should be able to look at the overall metrics like the number of daily visits, revenue produced on that day, customer satisfaction, how busy are different departments on that day, and general waiting time on that day. This tab should have a slicer of date.

* **Using the Doctors’ Tab,** the Chief Of Staff at the hospital should be able to look at the individual doctor’s performance metrics like customer satisfaction, the number of patients he was visited by, the revenue he has generated, and his appointment fees. This tab should have a slicer of the Doctor's Name or ID.

* **Using the Patients’ Tab,** the Patient’s Care Chief at the hospital wants to look at a customer’s profile which would involve metrics like the most frequently visited department, their age, their race, their waiting time, number of visits, the total amount that they have paid to the hospital, etc. All the metrics using which they can address the patient very carefully in their visits. This tab should have a slicer of the Patient's Name or ID.

**Make sure that all the visualizations look decent and are placed in a proper order. Each tab has different POCs (Point Of Contact), so make sure you involve all the metrics that POC may look at in that tab along with those mentioned in the tab description.**

**After making the report on the Desktop ensure that it is hosted on PowerBI service and use the hosted link for submission of the dashboard and mentioning on the resume.**