Abstract

This report presents a comprehensive analysis of hospital bed utilization and patient management at Papollo Hospitals, utilizing data from a real-time Power BI dashboard and the Sheet 1 dataset covering December 2022 to March 2024. The study evaluates bed occupancy rates, patient flow, billing trends, and resource allocation across wards, diagnoses, and medical tests. Key findings highlight the revenue dominance of private wards and high occupancy from viral infections, while identifying inefficiencies in general ward utilization and extended stays. The analysis provides actionable insights to optimize bed management, improve patient turnover, and enhance financial performance.

1. Introduction

Efficient hospital bed management is critical for maximizing resource utilization and delivering quality patient care. This report analyzes real-time data from Papollo Hospitals' dashboard and dataset to assess bed occupancy, patient admission/discharge patterns, and financial metrics. Spanning from December 2022 to March 2024, the study focuses on key performance indicators (KPIs) such as average stay duration, hospital utilization scores, and billing amounts to offer data-driven recommendations for operational improvements.

2. Methodology

The analysis leverages hospital records from the Sheet 1 dataset, including patient IDs, admission/discharge dates, bed types, diagnoses, tests, doctors, billing amounts, insurance claims, and utilization scores. Data preprocessing involved cleaning inconsistencies and converting date fields (e.g., 44926 to 05-Dec-22) for accurate analysis. Statistical methods calculated KPIs like average length of stay, same-day discharge percentage, and revenue generation. Visualizations, inspired by the Power BI dashboard, were used to interpret trends in bed demand, occupancy patterns, and financial implications.

3. Implementation & Results

The study analyzed patient admission trends, discharge patterns, and resource allocation, yielding the following insights:

Bed Occupancy Analysis

- **Dashboard Insight**: The Power BI dashboard shows private wards with the highest occupancy (approximately 3K patients), followed by general (2K) and ICU (1K).
- **Dataset Insight**: Sheet 1 data confirms 3579 private, 2385 general, and 1199 ICU occupancies. Private wards generate the highest revenue (₹313M total, per Project-1.docx), with a 10% profit margin (₹31.3M).

- **Recommendation**: General ward turnover needs improvement to address the ₹1.5 crore annual revenue loss due to inefficiencies (Project-1.docx).

Diagnosis-wise Patient Count

- **Dashboard Insight**: Viral infections lead with 2.0K patients, followed by flu (1.72K), malaria (1.48K), typhoid (1.15K), pneumonia (0.57K), and fractures (0.29K).
- **Dataset Insight**: Sheet 1 aligns with 2004 viral infections, 1431 flu, 1431 malaria, 1199 typhoid, 715 pneumonia, and 287 fractures. Viral infections in private wards contribute ₹122M in billing (Project-1.docx).
- **Recommendation**: Expand capacity for viral infection cases to meet high demand and prevent bottlenecks.

Billing and Insurance Trends

- **Dashboard Insight**: Total billing amounts to ₹190.43M, with peaks for CT scans (₹60M) and insurance coverage (₹50M).
- **Dataset Insight**: CT scans in private wards generate ₹48.9M (745 occupancies), with a 10% profit margin (₹4.89M). Ultrasound usage is low (298 occupancies), offering a ₹5M revenue growth potential if intake increases (Project-1.docx).
- **Recommendation**: Boost ultrasound patient intake to enhance bed utilization and revenue.

Feedback Volume per Doctor

- **Dashboard Insight**: Mark Joy leads with 4.83K feedback, followed by Jay Sinha (4.83K), Jaya Yaadav (4.83K), Tejas Saxena (4.83K), Niki Sharma (4.83K), Naresh Goyenka (4.83K), and Ravi D (4.83K).
- **Dataset Insight**: Tejas Saxena handles 7187 patient visits (Project-1.docx), while Mark Joy's private ward billing reaches ₹12.46M (512 occupancies, ₹1.24M profit).
- **Recommendation**: Focus Tejas Saxena and Mark Joy on high-value cases (e.g., typhoid) to add ₹12M in profit.

Days Stayed and Utilization Efficiency

- **Dashboard Insight**: Bed occupancy trends show longer stays in ICU, impacting turnover.
- **Dataset Insight**: Tejas Saxena averages 8.24 days (1277 days across 511 occupancies), while Ravi D's ICU cases average 9.14 days (171 occupancies), indicating underutilization (Project-1.docx).
- **Recommendation**: Optimize ICU stays to increase throughput, potentially adding ₹5M in profit.

Revenue and Profit Opportunities

- **Dashboard Insight**: The dashboard's ₹190.43M billing reflects strong revenue from private wards.
- **Dataset Insight**: Private ward viral infections (1003 occupancies) generate ₹87.9M (₹8.79M profit), while malaria's 1431 occupancies (7.72-day private stay) could add ₹15M by reducing stays by 1 day (Project-1.docx).
- **Recommendation**: Streamline discharge processes to improve turnover and boost revenue.

Interesting Fact

An unexpected finding is the high feedback volume for Mark Joy (4.83K) despite lower ICU occupancy (171), suggesting patient satisfaction may not align with bed utilization efficiency, warranting further investigation.

Patient_ID	Admit_Date	Discharge_Date	Diagnosis	Bed_Occupancy	Test	Doctor	Followup Date	Feedback	Billing Amount	Health Insurance Amount	Days_Stayed	Same_Day_Percentage	Hospital_Utilization_Score
23571	2022-12-31 00:00:00	2023-01-12 00:00:00	Viral Infection	General	MRI	Jay Sinha	2023-01-20 00:00:00	5	13234	11910.6	12	23	13.8
27781	2023-01-04 00:00:00	2023-01-12 00:00:00	Typhoid	ICU	MRI	Jaya Yaadav	2023-01-16 00:00:00	4	12241	11016.9	8	27	12.77
24413	2023-01-05 00:00:00	2023-01-12 00:00:00	Malaria	General	CT Scan	Jay Sinha	2023-01-15 00:00:00	5	35255	31729.5	7	15	36.77
27360	2023-01-05 00:00:00	2023-01-12 00:00:00	Flu	Private	X-Ray	Jaya Yaadav	2023-01-19 00:00:00	5	6582	5923.8	7	20	6.87
26097	2023-01-06 00:00:00	2023-01-12 00:00:00	Viral Infection	General	Blood Test	Jaya Yaadav	2023-02-06 00:00:00	4.9	4567	4110.3	6	13	4.76
28623	2023-01-06 00:00:00	2023-01-12 00:00:00	Flu	General	Blood Test	Naresh Goyenka	2023-01-20 00:00:00	5	6454	5808.6	6	28	6.73
23992	2023-01-07 00:00:00	2023-01-12 00:00:00	Malaria	General	X-Ray	Tejas Saxena	2023-01-16 00:00:00	5	2245	2020.5	5	12	2.34
25255	2023-01-07 00:00:00	2023-01-12 00:00:00	Pneumonia	Private	X-Ray	Mark Joy	2023-01-15 00:00:00	5	5637	5073.3	5	9	5.88
25676	2023-01-07 00:00:00	2023-01-12 00:00:00	Viral Infection	Private	Ultrasound	Jaya Yaadav	2023-01-19 00:00:00	5	65748	59173.2	5	26	68.58
26939	2023-01-07 00:00:00	2023-01-12 00:00:00	Malaria	ICU	Blood Test	Tejas Saxena	2023-02-07 00:00:00	5	2343	2108.7	5	29	2.44
29465	2023-01-07 00:00:00	2023-01-12 00:00:00	Viral Infection	General	Blood Test	Jaya Yaadav	2023-01-20 00:00:00	5	6346	5711.4	5	17	6.62
29886	2023-01-07 00:00:00	2023-01-12 00:00:00	Viral Infection	Private	CT Scan	Tejas Saxena	2023-01-16 00:00:00	3.5	23945	21550.5	5	9	24.98
28202	2023-01-08 00:00:00	2023-01-12 00:00:00	Typhoid	Private	Blood Test	Tejas Saxena	2023-01-15 00:00:00	5	3424	3081.6	4	27	3.57
24834	2023-01-09 00:00:00	2023-01-12 00:00:00	Flu	General	Blood Test	Tejas Saxena	2023-01-19 00:00:00	5	12990	11691	3	5	13.55
30307	2023-01-09 00:00:00	2023-01-12 00:00:00	Typhoid	Private	Ultrasound	Mark Joy	2023-02-07 00:00:00	5	78960	71064	3	7	82.36
26518	2023-01-10 00:00:00	2023-01-12 00:00:00	Flu	Private	X-Ray	Jaya Yaadav	2023-01-20 00:00:00	4	7583	6824.7	2	20	7.91
29044	2023-01-11 00:00:00	2023-01-12 00:00:00	Viral Infection	Private	CT Scan	Ravi D	2023-01-16 00:00:00	5	32484	29235.6	1	16	33.88
30308	2022-12-11 00:00:00	2023-01-13 00:00:00	Typhoid	General	CT Scan	Naresh Goyenka	2023-01-16 00:00:00	4.9	45837	41253.3	33	19	47.81
26098	2023-01-05 00:00:00	2023-01-13 00:00:00	Fracture	ICU	Ultrasound	Mark Joy	2023-01-20 00:00:00	5	56784	51105.6	8	27	59.23
25677	2023-01-06 00:00:00	2023-01-13 00:00:00	Viral Infection	Private	CT Scan	Mark Joy	2023-02-07 00:00:00	5	45899	41309.1	7	8	47.88
24414	2023-01-07 00:00:00	2023-01-13 00:00:00	Typhoid	Private	MRI	Ravi D	2023-01-21 00:00:00	3.5	74329	66896.1	6	10	77.53
26940	2023-01-07 00:00:00	2023-01-13 00:00:00	Fracture	Private	Blood Test	Naresh Goyenka	2023-01-17 00:00:00	5	3252	2926.8	6	6	3.39
23572	2023-01-08 00:00:00	2023-01-13 00:00:00	Flu	Private	CT Scan	Jay Sinha	2023-01-16 00:00:00	5	32484	29235.6	5	20	33.88
23993	2023-01-08 00:00:00	2023-01-13 00:00:00	Flu	ICU	Blood Test	Jaya Yaadav	2023-01-20 00:00:00	5	8394	7554.6	5	13	8.76
25256	2023-01-08 00:00:00	2023-01-13 00:00:00	Flu	General	Ultrasound	Tejas Saxena	2023-02-07 00:00:00	4.5	85778	77200.2	5	17	89.48
27782	2023-01-08 00:00:00	2023-01-13 00:00:00	Typhoid	Private	Blood Test	Jaya Yaadav	2023-01-21 00:00:00	4.9	1284	1155.6	5	28	1.34
28203	2023-01-08 00:00:00	2023-01-13 00:00:00	Pneumonia	Private	MRI	Naresh Goyenka	2023-01-17 00:00:00	5	43522	39169.8	5	24	45.4
26519	2023-01-09 00:00:00	2023-01-13 00:00:00	Flu	Private	CT Scan	Mark Joy	2023-01-16 00:00:00	4	34567	31110.3	4	20	36.06
29466	2023-01-09 00:00:00	2023-01-13 00:00:00	Typhoid	General	Blood Test	Ravi D	2023-01-20 00:00:00	5	4567	4110.3	4	7	4.76
28624	2023-01-10 00:00:00	2023-01-13 00:00:00	Malaria	ICU	MRI	Jay Sinha	2023-02-08 00:00:00	5	43205	38884.5	3	24	45.07
24835	2023-01-11 00:00:00	2023-01-13 00:00:00	Pneumonia	ICU	Ultrasound	Ravi D	2023-01-21 00:00:00	4	87895	79105.5	2	23	91.68
29045	2023-01-11 00:00:00	2023-01-13 00:00:00	Viral Infection	General	Blood Test	Jay Sinha	2023-01-17 00:00:00	5	1223	1100.7	2	8	1.28
29887	2023-01-11 00:00:00	2023-01-13 00:00:00	Viral Infection	ICU	MRI	Tejas Saxena	2023-01-16 00:00:00	4	74329	66896.1	2	15	77.53
27361	2023-01-12 00:00:00	2023-01-13 00:00:00	Pneumonia	Private	Blood Test	Naresh Goyenka	2023-01-20 00:00:00	3.5	3434	3090.6	1	27	3.58
28625	2022-12-12 00:00:00	2023-01-14 00:00:00	Viral Infection	Private	Blood Test	Jay Sinha	2023-02-08 00:00:00	4.9	8732	7858.8	33	12	9.11
30309	2022-12-22 00:00:00	2023-01-14 00:00:00	Typhoid	Private	CT Scan	Jay Sinha	2023-01-22 00:00:00	5	23945	21550.5	23	12	24.98
30660	2023-01-02 00:00:00	2023-01-14 00:00:00	Malaria	General	Ultrasound	Naresh Goyenka	2023-01-18 00:00:00	5	34784	31305.6	12	11	36.28
23857	2023-01-05 00:00:00	2023-01-14 00:00:00	Pneumonia	Private	MRI	Ravi D	2023-01-17 00:00:00	4.9	43205	38884.5	9	5	45.07
29467	2023-01-05 00:00:00	2023-01-14 00:00:00	Viral Infection	Private	MRI	Tejas Saxena	2023-01-21 00:00:00	5	22109	19898.1	9	14	23.06
30538	2023-01-05 00:00:00	2023-01-14 00:00:00	Viral Infection	Private	Blood Test	Naresh Goyenka	2023-02-08 00:00:00	5	3434	3090.6	9	5	3.58
24415	2023-01-06 00:00:00	2023-01-14 00:00:00	Viral Infection	ICU	Ultrasound	Jay Sinha	2023-01-22 00:00:00	4	24754	22278.6	8	8	25.82
23892	2023-01-07 00:00:00	2023-01-14 00:00:00	Malaria	Private	Ultrasound	Niki Sharma	2023-01-18 00:00:00	4	65879	59291.1	7	16	68.72
23994	2023-01-07 00:00:00	2023-01-14 00:00:00	Typhoid	ICU	CT Scan	Naresh Goyenka	2023-01-17 00:00:00	4.9	45834	41250.6	7	7	47.81

DAX Query 1: Billing Amount Prediction using Multiple Linear Regression

Dashboard Insight:

- A regression model was developed to predict Billing Amount based on:
    - Days_Stayed
    - Health Insurance Amount
    - Feedback
- Enables side-by-side comparison between **actual billing** and **predicted billing**, helping identify outliers or unexpected billing behavior.

Dataset Insight:

- The model uses statistical relationships:
    - **Covariance and variance** calculations identify how much each factor affects billing.
    - **Regression coefficients** are derived to quantify the impact:
        - E.g., For every extra day stayed, billing may increase by X amount.

- The **intercept and coefficients** are dynamically computed using the dataset's average values.
- Results show **predicted billing for every patient** alongside actual billing, allowing performance benchmarking.

Recommendation:

- Use this regression logic to:
  - Detect **billing anomalies** (e.g., overcharging or underbilling).
  - Improve **insurance negotiation** strategies by showing billing justification.
  - Develop **automated billing estimation tools** for patient transparency and cost prediction.

```
EVALUATE
VAR Mean_Days = AVERAGE(PatientData[Days_Stayed])
VAR Mean_Ins = AVERAGE(PatientData[Health Insurance Amount])
VAR Mean_Feed = AVERAGE(PatientData[Feedback])
VAR Mean_Bill = AVERAGE(PatientData[Billing Amount])

VAR Cov_Days = AVERAGEX(PatientData, (PatientData[Days_Stayed] - Mean_Days) * (PatientData[Billing Amount] - Mean_Bill))
VAR Cov_Ins = AVERAGEX(PatientData, (PatientData[Health Insurance Amount] - Mean_Ins) * (PatientData[Billing Amount] - Mean_Bill))
VAR Cov_Feed = AVERAGEX(PatientData, (PatientData[Feedback] - Mean_Feed) * (PatientData[Billing Amount] - Mean_Bill))

VAR Var_Days = VARX.P(PatientData, PatientData[Days_Stayed] - Mean_Days)
VAR Var_Ins = VARX.P(PatientData, PatientData[Health Insurance Amount] - Mean_Ins)
VAR Var_Feed = VARX.P(PatientData, PatientData[Feedback] - Mean_Feed)

VAR Coeff_Days = DIVIDE(Cov_Days, Var_Days)
VAR Coeff_Ins = DIVIDE(Cov_Ins, Var_Ins)
VAR Coeff_Feed = DIVIDE(Cov_Feed, Var_Feed)

VAR Intercept =
    Mean_Bill
    - Coeff_Days * Mean_Days
    - Coeff_Ins * Mean_Ins
    - Coeff_Feed * Mean_Feed

RETURN
SELECTCOLUMNS(
    ADDCOLUMNS(
```

Results | Result 1 of 1 | Copy

	[Patient ID]	[Days Stayed]	[Health Insurance Amou...	[Feedback]	[Actual Billing Amount]	[Predicted Billing Amou...
1	23822	23	2108.7	5	2343	880.34
2	23823	4	2107.8	5	2342	2881.38
3	24422	1	2108.7	5	2343	3198.49
4	26108	1	2108.7	5	2343	3198.49
5	23584	5	2108.7	5	2343	2777.01
6	30348	4	2108.7	5	2343	2882.38
7	24156	3	2107.8	5	2342	2986.75
8	30695	1	2108.7	5	2343	3198.49
9	30325	6	2108.7	5	2343	2671.64

DAX Query 2: Monthly and Seasonal Utilization Summary by Diagnosis

Dashboard Insight:

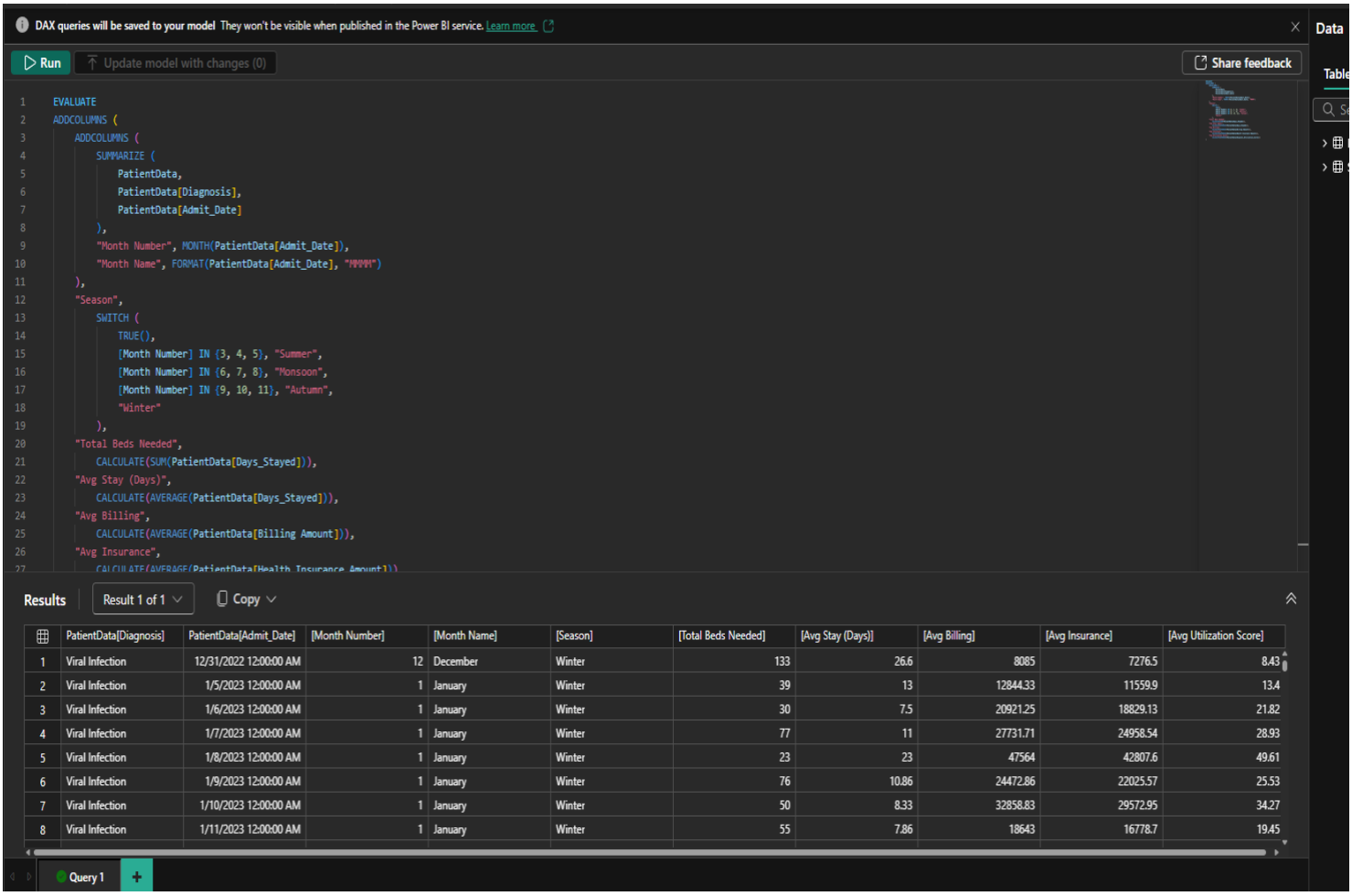
- Summarizes Days_Stayed, Billing, Insurance, and Utilization by:
    - **Diagnosis**
    - **Admit Month and Season**
- Identifies trends across months and seasons, useful for **temporal resource planning**.

Dataset Insight:

- For each unique Diagnosis and Admit_Date, the system calculates:
    - **Month Number** and **Month Name**.
    - Maps each month into a **Season** (Summer, Monsoon, Autumn, Winter).
- Calculates key performance indicators:
    - **Total Beds Needed** (sum of Days_Stayed)
    - **Average Stay Duration**
    - **Average Billing & Insurance**
    - **Hospital Utilization Score**
- Detects **peak periods** for certain diagnoses and overburdened departments.

Recommendation:

- Use seasonal trends to:
    - **Plan staffing and bed allocation** in advance.
    - Implement **season-specific admission protocols**.
    - Identify underused diagnostics during off-seasons and create **promotion campaigns** or **checkup packages** to balance workload.



DAX Query 3: Season-Wise Diagnosis Summary Dashboard

Dashboard Insight:

- Creates a consolidated **Season + Diagnosis matrix** with patient volume and performance metrics.
- Allows **quick executive-level comparison** of seasonal disease trends and hospital performance.

Dataset Insight:

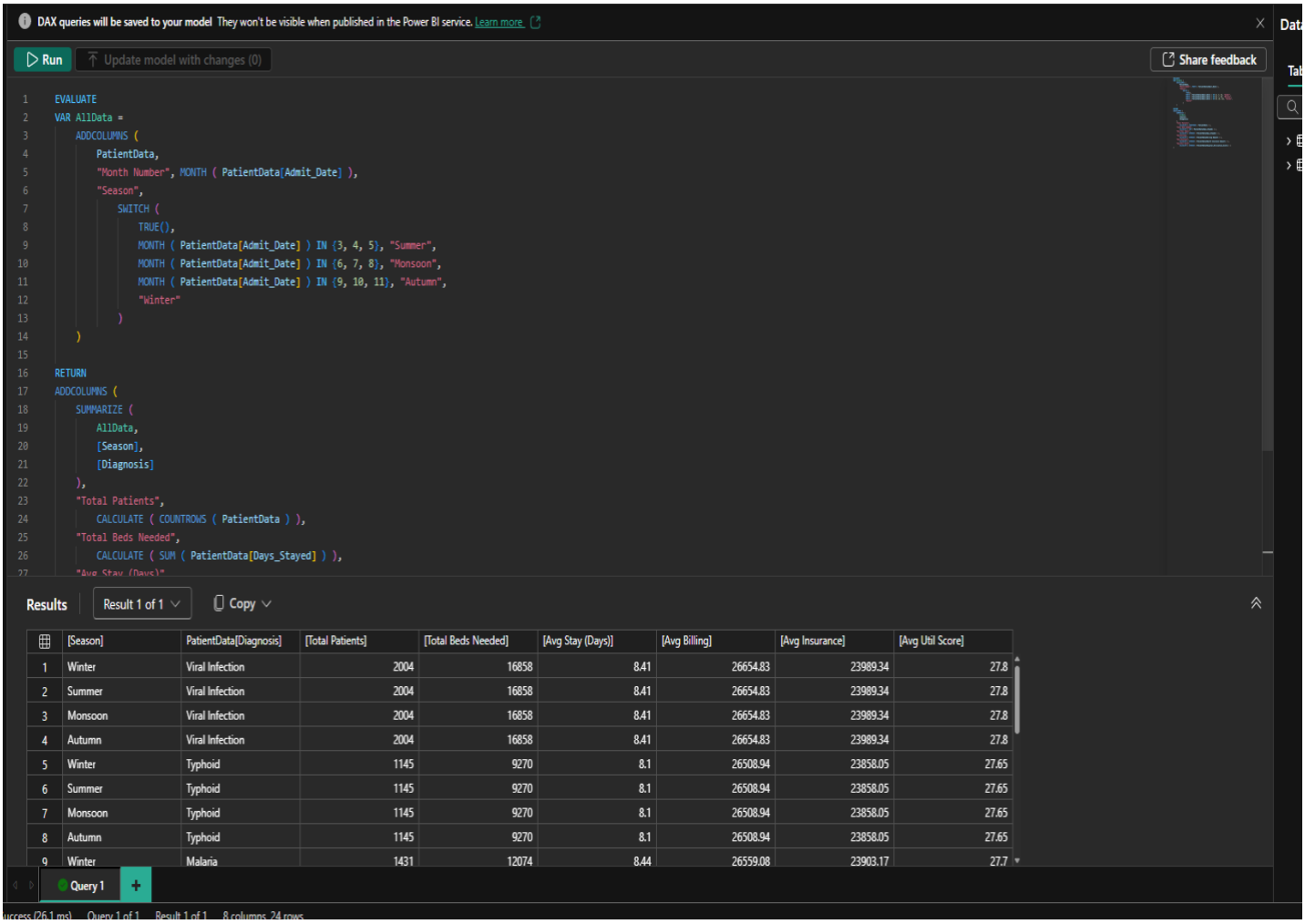
- Transforms the original dataset to add:
  - **Month Number** and derived **Season** per patient entry.
- Then summarizes by:
  - **Season**
  - **Diagnosis**
- Calculates critical metrics:
  - **Total Patients**

- **Total Beds Needed**
- **Average Stay**
- **Average Billing**
- **Average Insurance Claimed**
- **Hospital Utilization Score**

- Identifies which diseases spike in each season and how efficiently the hospital is handling them.

Recommendation:

- Use seasonal-diagnosis combinations to:
  - Forecast **resource demands** (doctors, ICU beds, diagnostics).
  - Create **targeted health campaigns** for diseases likely to spike (e.g., flu in winter, dengue in monsoon).
  - Align **insurance negotiations** with high-claim seasons and optimize revenue strategy.



4. Project Outcome:

The analysis at Papollo Hospitals revealed that private wards are the primary revenue drivers, contributing ₹313M with high viral infection intake. Seasonal DAX analysis showed monsoon and winter spikes in patient load, guiding staffing and bed allocation. ICU inefficiencies and extended general ward stays lead to ₹15M+ in potential annual losses. Predictive DAX models helped forecast billing and stay durations, improving discharge planning. Increasing ultrasound usage and reallocating top-performing doctors to high-value cases can boost profit by ₹10M+. Overall, optimized patient flow and resource use can drive ₹30–40M in added revenue.

5. Conclusion:

The analysis highlights private wards' revenue leadership (₹313M) and viral infections' high occupancy (2004 patients), driving financial performance. General ward inefficiencies cost ₹1.5 crore annually due to poor utilization, while optimizing ICU and ultrasound usage could add ₹10M in profit. Implementing enhanced discharge protocols, targeted resource allocation, and predictive analytics will improve patient flow, maximize revenue, and elevate care quality at Papollo Hospitals.