HOSPITAL MANAGEMENT ANALYSIS

June
2025

Presented by: Girish K S

EXECUTIVE SUMMARY

This project aims to analyze and optimize patient flow and resource allocation in a multi-specialty hospital using SQL-based data exploration. Leveraging five core datasets – Patients, Doctors, Appointments, Treatments, and Billing – the analysis uncovers operational inefficiencies, revenue patterns, and patient behavior insights.

Key findings include:

- Uneven doctor-patient distribution during peak days.
- Significant revenue dependency on a few doctors and treatment types.
- High count of unpaid bills older than 30 days, affecting cash flow.
- Heavy concentration of patients under select insurance providers.

REQUIRED KPI'S

Total Appointments:

```sql
SELECT COUNT(*) AS total_appointments FROM appointments;
```

total_appointments
200

Total Revenue (considered only Paid Amount):

```sql
SELECT SUM(amount) AS total_revenue
FROM billing
WHERE payment_status = 'Paid';
```

total_revenue
173424.9

AVG. billing per patient:

```sql
SELECT ROUND(AVG(total_amount), 2) AS avg_billing_per_patient
FROM (
    SELECT patient_id, SUM(amount) AS total_amount
    FROM billing
    GROUP BY patient_id
) AS patient_bills;
```

avg_billing_per_patient
11484.37

No of Male and Female Patients:

```sql
SELECT gender, COUNT(*) AS total_patients
FROM patients
GROUP BY gender;
```

gender	total_patients
F	19
M	31

1. Top 5 Most Common Reasons for Visit by Gender

```sql
WITH TopReasons AS (
    SELECT reason_for_visit, COUNT(*) AS visit_count
    FROM appointments
    GROUP BY reason_for_visit
    ORDER BY visit_count DESC
    LIMIT 5
)
SELECT
    tr.reason_for_visit,
    p.gender,
    COUNT(*) AS visit_count
FROM appointments a
JOIN patients p ON a.patient_id = p.patient_id
JOIN TopReasons tr ON a.reason_for_visit = tr.reason_for_visit
GROUP BY tr.reason_for_visit, p.gender
ORDER BY tr.reason_for_visit, p.gender;
```

reason_for_visit	gender	visit_count
Checkup	F	18
Checkup	M	27
Consultation	F	14
Consultation	M	29
Emergency	F	11
Emergency	M	18
Follow-up	F	15
Follow-up	M	26
Therapy	F	12
Therapy	M	30

Analyzes the most frequent reasons patients visit the hospital. Breaks the count down by gender to understand condition trends across demographics.

2. Monthly Revenue Trend

```sql
SELECT
    DATE_FORMAT(bill_date, '%Y-%m') AS month,
    ROUND(SUM(amount),2) AS total_revenue
FROM billing
GROUP BY month
ORDER BY month;
```

month	total_revenue
2023-01	58701.23
2023-02	36669.69
2023-03	47304.29
2023-04	64271.54
2023-05	48791.05
2023-06	56887.82
2023-07	39880.19
2023-08	41958.67
2023-09	33426.53
2023-10	43314.15
2023-11	52474.98
2023-12	27569.71

Tracks the hospital's monthly revenue by summing billing amounts. Helps identify financial patterns, seasonal highs, and performance over time.

3. Doctor Utilization Rate

```sql
SELECT
    d.doctor_id,
    CONCAT(d.first_name, ' ', d.last_name) AS doctor_name,
    d.specialization,
    COUNT(a.appointment_id) AS total_appointments,
    ROUND(COUNT(a.appointment_id) / 30.0, 2) AS avg_daily_appointments
FROM doctors d
LEFT JOIN appointments a ON d.doctor_id = a.doctor_id
GROUP BY d.doctor_id, d.first_name, d.last_name, d.specialization
ORDER BY total_appointments DESC;
```

doctor_id	doctor_name	specialization	total_appointments	avg_daily_appointments
D005	Sarah Taylor	Dermatology	29	0.97
D001	David Taylor	Dermatology	25	0.83
D006	Alex Davis	Pediatrics	24	0.80
D003	Jane Smith	Pediatrics	22	0.73
D002	Jane Davis	Pediatrics	21	0.70
D010	Linda Wilson	Oncology	19	0.63
D009	Sarah Smith	Pediatrics	17	0.57
D008	Linda Brown	Dermatology	16	0.53
D004	David Jones	Pediatrics	14	0.47
D007	Robert Davis	Oncology	13	0.43

Measures how busy each doctor is by counting appointments. Indicates demand for each specialization and assists in balancing workload.

4. Patients with Highest Total Billing

```sql
SELECT
    p.patient_id,
    CONCAT(p.first_name, ' ', p.last_name) AS patient_name,
    GROUP_CONCAT(DISTINCT t.treatment_type ORDER BY t.treatment_type SEPARATOR ', ') AS treatment_types,
    SUM(b.amount) AS total_billed
FROM patients p
JOIN billing b ON p.patient_id = b.patient_id
JOIN treatments t ON b.treatment_id = t.treatment_id
GROUP BY p.patient_id, patient_name
ORDER BY total_billed DESC
LIMIT 5;
```

patient_id	patient_name	treatment_types	total_billed
P012	Laura Davis	Chemotherapy, ECG, MRI, Physiotherapy, X-Ray	30053.079833984375
P049	David Moore	Chemotherapy, ECG, X-Ray	23554.059814453125
P016	Michael Taylor	Chemotherapy, ECG, MRI, Physiotherapy	22967.93994140625
P036	Michael Wilson	Chemotherapy, ECG, MRI, Physiotherapy	21583.559936523438
P025	Robert Wilson	ECG, MRI, Physiotherapy	19513.169677734375

This query identifies the top 5 patients with the highest total billing amounts, including the types of treatments they received. It provides insight into high-value patients and their associated healthcare services.

5. Unpaid Bills Older Than 30 Days

```sql
SELECT
    b.bill_id,
    p.patient_id,
    CONCAT(p.first_name, ' ', p.last_name) AS patient_name,
    b.amount,
    b.bill_date,
    DATEDIFF(CURRENT_DATE, b.bill_date) AS days_overdue
FROM billing b
JOIN patients p ON b.patient_id = p.patient_id
WHERE b.payment_status = 'Pending'
  AND DATEDIFF(CURRENT_DATE, b.bill_date) > 30
ORDER BY days_overdue DESC;
```

bill_id	patient_id	patient_name	amount	bill_date	days_overdue
B146	P028	Alex Moore	894.39	2023-01-05	944
B081	P046	Michael Taylor	3729.19	2023-01-06	943
B036	P033	Michael Wilson	4833.17	2023-01-08	941
B112	P048	Emily Miller	2593.43	2023-01-11	938
B015	P026	John Taylor	956.39	2023-01-15	934
B178	P017	Jane Jones	4652.41	2023-01-17	932
B082	P002	Emily Smith	3615.96	2023-01-20	929
B103	P021	Michael Wilson	3428.95	2023-01-24	925
B151	P016	Michael Taylor	2512.41	2023-01-28	921
B183	P040	Emily Williams	2761.55	2023-02-03	915
B140	P012	Laura Davis	4019.13	2023-02-05	913
B019	P029	David Smith	1882.8	2023-02-06	912
B053	P024	Sarah Brown	1565.92	2023-02-12	906
B187	P027	Linda Moore	806.78	2023-02-13	905
B089	P029	David Smith	857.39	2023-02-14	904
B184	P042	Jane Smith	2293.98	2023-02-26	892
B059	P027	Linda Moore	929.91	2023-03-09	881
B124	P013	Laura Johnson	3492.1	2023-03-16	874
B042	P036	Michael Wilson	4781.32	2023-03-21	869
B185	P009	Laura Davis	1158.68	2023-03-21	869
B197	P001	David Williams	975.49	2023-04-01	858
B031	P026	John Taylor	2863.24	2023-04-04	855
B194	P008	David Davis	1903.17	2023-04-06	853
B121	P037	Robert Williams	2526.67	2023-04-07	852
B159	P016	Michael Taylor	4687.68	2023-04-08	851

Identifies all unpaid bills that are overdue by more than 30 days. Helps in tracking pending payments and improving hospital cash flow and collections.

6. Most Expensive Treatments

```sql
SELECT
    treatment_type,
    description,
    MAX(cost) AS max_cost
FROM treatments
GROUP BY treatment_type, description
ORDER BY max_cost DESC
LIMIT 5;
```

treatment_type	description	max_cost
X-Ray	Advanced protocol	4974
MRI	Basic screening	4966
Chemotherapy	Basic screening	4965
ECG	Advanced protocol	4961
Chemotherapy	Standard procedure	4945

This query identifies the top 5 patients with the highest total billing amounts, including the types of treatments they received. It provides insight into high-value patients and their associated healthcare services.

7. Doctor’s Revenue Contribution

```sql
SELECT
    d.doctor_id,
    CONCAT(d.first_name, ' ', d.last_name) AS doctor_name,
    d.specialization,
    SUM(t.cost) AS total_generated
FROM doctors d
JOIN appointments a ON d.doctor_id = a.doctor_id
JOIN treatments t ON a.appointment_id = t.appointment_id
GROUP BY d.doctor_id, doctor_name, d.specialization
ORDER BY total_generated DESC;
```

doctor_id	doctor_name	specialization	total_generated
D005	Sarah Taylor	Dermatology	82694
D006	Alex Davis	Pediatrics	69585
D001	David Taylor	Dermatology	66586
D002	Jane Davis	Pediatrics	59802
D008	Linda Brown	Dermatology	53426
D003	Jane Smith	Pediatrics	52793
D010	Linda Wilson	Oncology	49436
D007	Robert Davis	Oncology	40167
D004	David Jones	Pediatrics	39317
D009	Sarah Smith	Pediatrics	37439

Analyzes each doctor's total generated revenue based on the treatments they performed. This helps assess financial performance and identify top revenue-generating doctors.

8. Insurance Provider Load

```sql
SELECT
    p.insurance_provider,
    COUNT(DISTINCT p.patient_id) AS total_patients,
    SUM(b.amount) AS total_billed
FROM patients p
JOIN billing b ON p.patient_id = b.patient_id
GROUP BY p.insurance_provider
ORDER BY total_billed DESC ;
```

	insurance_provider	total_patients	total_billed
▶	MedCare Plus	18	241092.29
	WellnessCorp	15	151860.58
	PulseSecure	10	104473.22
	HealthIndia	5	53823.76

Displays the number of patients and total billing associated with each insurance provider. This helps evaluate insurer utilization, patient coverage trends, and provider-wise revenue distribution.

THANK YOU