Case study on Medicore

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Medi Core Healthcare – Comprehensive Report on Relational Database Model for Appointment and Operations Management

1. Introduction

Healthcare organizations today face an increasing demand for efficiency, accuracy, and compliance in managing their operations. With growing patient volumes, complex billing structures, and multiple funding sources, manual or fragmented systems often lead to errors, delays, and data redundancy. To address these challenges, modern healthcare facilities are turning to Relational Database Management Systems (RDBMS) that provide a structured and reliable framework for storing, retrieving, and analyzing critical information.

This case study focuses on the design of a healthcare database model that supports appointment scheduling, patient record management, staff coordination, service tracking, and financial analysis. By applying principles of data normalization and integrity, the system ensures that sensitive patient and clinical information is stored securely, accessible when needed, and free from duplication.

The proposed database not only enhances day-to-day operational efficiency but also provides strategic insights into service utilization, payer contributions, and revenue patterns. In doing so, it lays the groundwork for more advanced systems such as Electronic Health Records (EHRs) and supports compliance with healthcare regulations, ultimately improving decision-making and the quality of care delivered.

2. Objectives

The main objectives of this healthcare database system are:

1. Improve Data Integrity & Reduce Redundancy – Eliminate duplication of patient, employee, and service information through normalization.

2. Enable Comprehensive Retrieval – Provide quick access to patient history, current treatment plans, and complete billing records.

3. Support Service Utilization Analysis – Allow reports to distinguish services by funding source (public/government-funded vs. private/insurance-based).

3. Purpose of the System

The purpose of this healthcare database is to ensure smooth day-to-day operations while maintaining compliance with regulatory standards. Its main functions are:

- Secure Storage of Patient/Client Data – Protecting sensitive health information.

- Service Tracking – Recording healthcare services such as therapy sessions, counseling, or home care visits.

- Staff Management – Tracking roles, specialties, and workload for doctors, nurses, and caregivers.

- Billing & Financial Management – Handling both government-funded (AHS contracts) and private-pay (insurance/out-of-pocket) billing.

- Regulatory Compliance & Accountability – Providing auditable records for healthcare contracts and standards.

4. Core Entities

The database design revolves around six key entities, each representing an essential aspect of healthcare operations:

1. Patient – Individuals receiving healthcare services. Stores demographics and identifiers.

2. Employee – Doctors, nurses, therapists, and administrative staff. Contains role and credentials.

3. Service – Types of healthcare services (e.g., physiotherapy, consultation). Includes duration and cost.

4. Status – Tracks appointment status (Scheduled, Completed, Cancelled, No-show).

5. Payer – Funding source, such as government, private insurance, or self-pay.

6. Appointment – Central fact table linking all entities together with date and time.

Additionally, a Datetime table supports precise scheduling and reporting.

patient Table

Attribute	Data Type	Constraint	Description
Patient ID	INT	PK, AUTO_INCREMENT	Unique identifier for each patient
Persona Health Number	VARCHAR (10)	NOT NULL, UNIQUE	Government-issued health ID
First Name	VARCHAR (50)	NOT NULL	Patient's first name
Last Name	VARCHAR (50)	NOT NULL	Patient's last name
Birthdate	DATE	NOT NULL	Patient's date of birth
Gender	CHAR (1)	NOT NULL	Patient's gender (M/F)
Address	VARCHAR (100)	NULL	Patient's residential address
City	VARCHAR (50)	NULL	City of residence
Province	VARCHAR (50)	NULL	Province of residence
Postal Code	VARCHAR (10)	NULL	Postal code
Email	VARCHAR (100)	UNIQUE	Patient's email address
Emergency Contact Name	VARCHAR (100)	NULL	Emergency contact person
Emergency Contact Phone	VARCHAR (15)	NULL	Emergency contact phone
Date Registered	DATE	DEFAULT CURRENT_DATE	Registration date

Employee

Attribute	Data Type	Constraint	Description
Employee ID	INT	PK, AUTO_INCREMENT	Unique identifier for each employee
First Name	VARCHAR (50)	NOT NULL	Employee's first name
Last Name	VARCHAR (50)	NOT NULL	Employee's last name
Role	ENUM ('Doctor', 'Nurse', 'Therapist' ,'Admin', 'Physician', 'Caregiver')	NOT NULL	Employee's job role

Speciality	VARCHAR (100)	NULL	Employee's specialty if applicable
Phone Number	VARCHAR (15)	NULL	Employee's phone number
Email	VARCHAR (100)	UNIQUE	Employee's email address
Hire Date	DATE	NOT NULL	Employment start date

Service

Attribute	Data Type	Constraint	Description
Service ID	INT	PK, AUTO_INCREMENT	Unique identifier for each service
Service Name	VARCHAR (100)	NOT NULL	Name of the service
Category	VARCHAR (50)	NULL	Category (Consultation, Therapy, Procedure)
Duration	TIME	NULL	Average service duration
Cost	DECIMAL (10,2)	NOT NULL	Service cost

Status

Attribute	Data Type	Constraint	Description
Status ID	INT	PK, AUTO_INCREMENT	Unique identifier for status
status Name	ENUM ('Scheduled', 'Completed', 'Cancelled', 'No-Show')	NOT NULL	Appointment status Scheduled: Booked but not yet happened Completed: Happened and finished Cancelled: Cancelled before the scheduled time No-Show: Missed without cancellation
Description	VARCHAR (100)	NULL	Optional notes about the status

Payer

Attribute	Data Type	Constraint	Description
Payer ID	INT	PK, AUTO_INCREMENT	Unique identifier for payer
Payer Name	ENUM ('Government' ,'Self-Payment', 'Alberta Blue Cross' ,'SunLife', 'Canada life')	NOT NULL, UNIQUE	Name of payer
Payer Type	VARCHAR (50)	NOT NULL	Type of payer
Payment Method	VARCHAR (50)	NULL	Payment method

Date Time

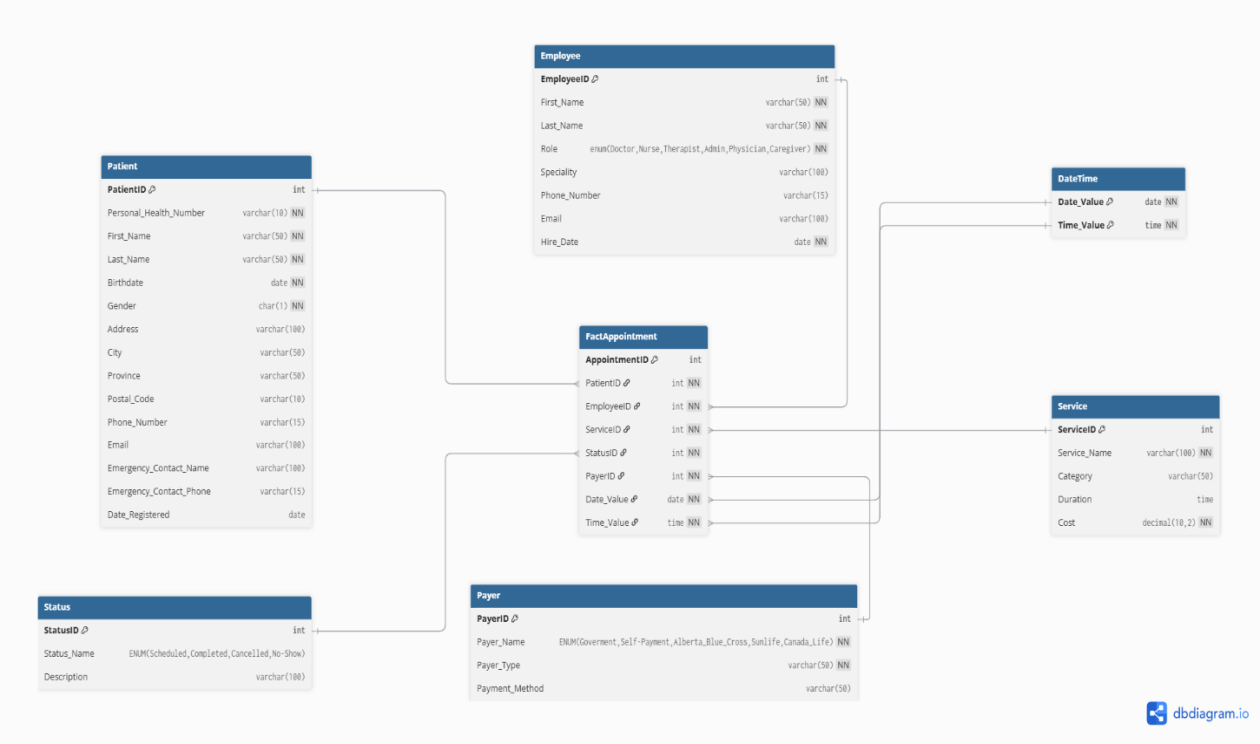
Attribute	Data Type	Constraint	Description
Date Value	DATE	PK, NOT NULL	Date of the appointment
Time Value	TIME	PK, NOT NULL	Time of the appointment

Appointment

Attribute	Data Type	Constraint	Description
Appointment ID	INT	PK, AUTO_INCREMENT	Unique identifier for each appointment
Patient ID	INT	NOT NULL, FK → Patient (Patient ID)	Patient linked to this appointment
Employee ID	INT	NOT NULL, FK → Employee (Employee ID)	Employee handling the appointment
Service ID	INT	NOT NULL, FK → Service (Service ID)	Service provided
Date Value	DATE	NOT NULL, FK → Date Time (Date Value)	Date of the appointment
Time Value	TIME	NOT NULL, FK → Date Time (Time Value)	Time of the appointment
Status ID	INT	NOT NULL, FK → Status (Status ID)	Status of appointment
Payer ID	INT	NOT NULL, FK → Payer (Payer ID)	Payer for the appointment

5. Entity Relationship Diagram (ERD)

The ERD illustrates how Patients, Employees, Services, Status, and Payers connect through the Appointment table, creating a complete record of healthcare transactions.



6.Entity Relationship

Dimension Table	Fact Table	Cardinality	Description
Patient	Appointment	1 → Many	One patient can have many appointments. Each appointment has exactly one patient.
Employee	Appointment	1 → Many	One employee can attend many appointments. Each appointment has exactly one employee.
Service	Appointment	1 → Many	One service can be in many appointments. Each appointment corresponds to a single service.
Status	Appointment	1 → Many	One status can apply to many appointments. Each appointment has exactly one status.
Payer	Appointment	1 → Many	One payer can cover many appointments. Each appointment has exactly one payer.
DateTime	Appointment	1 → Many	Each unique date and time combination can have many appointments (different patients/employees). Each appointment has exactly one DateTime.

7.SQL Views and Analytical Framework

View 1: Patient Appointments

Purpose / analysis:
Provides a comprehensive list of all appointments with linked patient, employee, service, date, time, status, and payer.
Source Tables: Appointment, Patient, Employee, Service, Status, Payer, Date Time.

```
CREATE VIEW vw_PatientAppointments AS
SELECT
    fa.AppointmentID,
    p.PatientID,
    CONCAT(p.First_Name, ' ', p.Last_Name) AS Patient_Name,
    e.EmployeeID,
    CONCAT(e.First_Name, ' ', e.Last_Name) AS Employee_Name,
    s.Service_Name,
    fa.Date_Value,
    fa.Time_Value,
    st.Status_Name,
    pr.Payer_Name
FROM Appointment fa
JOIN Patient p ON fa.PatientID = p.PatientID
JOIN Employee e ON fa.EmployeeID = e.EmployeeID
JOIN Service s ON fa.ServiceID = s.ServiceID
JOIN Status st ON fa.StatusID = st.StatusID
JOIN Payer pr ON fa.PayerID = pr.PayerID;
```

Columns included:
- Appointment ID
- Patient Id, Patient Name
- Employee Id, Employee name
- Service Name
- Date value, Time value
- Status Name
- Payer Name

RESULT

Analysis examples:
-Track which patients are seeing which employees/services.
-Identify patient load per employee.
-Monitor appointment patterns by status (scheduled, completed, no-show).

	AppointmentID	PatientID	Patient_Name	EmployeeID	Employee_Name	Service_Name	Date_Value	Time_Value	Status_Name	Payer_Name
1	86	6	Laura Taylor	8	Paul Allen	Pediatric Checkup	2025-09-02	11:45:00	No-Show	Goverment
2	83	3	Robert Brown	2	Mark Evans	Physical Therapy	2025-09-01	11:00:00	Cancelled	Goverment
3	91	11	Daniel Young	12	David Scott	Pediatric Checkup	2025-09-04	8:00:00	Cancelled	Goverment
4	96	16	Ava Green	16	James Perez	Pediatric Checkup	2025-09-05	16:30:00	Cancelled	Goverment
5	92	12	Emma King	11	Laura Hill	General Consulta…	2025-09-04	9:00:00	Completed	Self-Payment
6	81	1	John Doe	3	Jessica Harris	Cardiology Follo…	2025-09-01	9:00:00	Scheduled	Self-Payment
7	87	7	Michael Lee	5	Karen Walker	General Consulta…	2025-09-03	8:30:00	Scheduled	Self-Payment
8	97	17	William Adams	17	Emily Carter	General Consulta…	2025-09-06	9:00:00	Scheduled	Self-Payment
9	93	13	Benjamin Wright	14	Daniel Baker	Cardiology Follo…	2025-09-04	11:00:00	No-Show	Alberta_Blue_…
1…	98	18	Mia Baker	18	Robert Ward	Physical Therapy	2025-09-06	10:30:00	No-Show	Alberta_Blue_…
1…	88	8	Sophia Martin	7	Rachel Lewis	Physical Therapy	2025-09-03	9:45:00	Cancelled	Alberta_Blue_…

VIEW2: Daily Schedule

Purpose / analysis:
Shows the daily schedule of employees including patients, services, and appointment status.
Source Tables: Appointment, Employee, Patient, Service, Status, Date Time.

```
CREATE VIEW vw_DailySchedule AS
SELECT
    e.EmployeeID,
    CONCAT(e.First_Name, ' ', e.Last_Name) AS Employee_Name,
    fa.Date_Value,
    fa.Time_Value,
    s.Service_Name,
    CONCAT(p.First_Name, ' ', p.Last_Name) AS Patient_Name,
    st.Status_Name
FROM Appointment fa
JOIN Employee e ON fa.EmployeeID = e.EmployeeID
JOIN Service s ON fa.ServiceID = s.ServiceID
JOIN Patient p ON fa.PatientID = p.PatientID
JOIN Status st ON fa.StatusID = st.StatusID
ORDER BY e.EmployeeID, fa.Date_Value, fa.Time_Value;
```

Columns included:
- Employee id, Employee name
- Date value, Time value
- Service Name
- Patient Name
- Status Name

RESULT

Analysis examples:
-Employee workload per day / shift planning.
-Identify time slots with no appointments.
-Analyze service utilization by employee.

EmployeeID	Employee_Name	Date_Value	Time_Value	Service_Name	Patient_Name	Status_Name
1	Sarah Thompson	2025-09-02	9:30:00	General Consultation	Emily Johnson	Scheduled
2	Mark Evans	2025-09-01	11:00:00	Physical Therapy	Robert Brown	Cancelled
3	Jessica Harris	2025-09-01	9:00:00	Cardiology Follow-up	John Doe	Scheduled
4	Thomas Robinson	2025-09-01	10:00:00	Pediatric Checkup	Alice Smith	Completed
5	Karen Walker	2025-09-03	8:30:00	General Consultation	Michael Lee	Scheduled
6	Steven White	2025-09-02	10:15:00	Dermatology Exam	David Wilson	Completed
7	Rachel Lewis	2025-09-03	9:45:00	Physical Therapy	Sophia Martin	Cancelled
8	Paul Allen	2025-09-02	11:45:00	Pediatric Checkup	Laura Taylor	No-Show
9	Sophia Young	2025-09-03	10:30:00	Cardiology Follow-up	James Clark	Completed
10	Kevin King	2025-09-03	14:00:00	Dermatology Exam	Olivia Hall	Scheduled

VIEW 3: Service Revenue

Purpose / analysis: Aggregates total appointments and revenue per service (only completed appointments).
Sources Tables: Appointment, Service, Status.

```
CREATE VIEW vw_ServiceRevenue AS
SELECT
    s.Service_Name,
    COUNT(fa.AppointmentID) AS Total_Appointments,
    SUM(s.Cost) AS Total_Revenue
FROM Appointment fa
JOIN Service s ON fa.ServiceID = s.ServiceID
JOIN Status st ON fa.StatusID = st.StatusID
WHERE st.Status_Name = 'Completed'
GROUP BY s.Service_Name;
```

Columns included:
- Service Name
- Total Appointments
- Total Revenue

Filter:
Status Name = 'Completed'

RESULT

Analysis examples:

-Determine most profitable services.
-Monitor service demand and revenue trends.
-Support financial reporting management.

Service_Name	Total_Appointments	Total_Revenue
Pediatric Checkup	1	120.00
Dermatology Exam	2	400.00
Cardiology Follo…	2	500.00
General Consulta…	1	100.00

VIEW4: Player Analysis

Purpose / analysis:
Shows total appointments and billed amounts per payer type (Insurance, Government, Self-Pay).
Source Tables: Appointment, Payer, Service

```
CREATE VIEW vw_PayerAnalysis AS
SELECT
    pr.Payer_Name,
    pr.Payer_Type,
    COUNT(fa.AppointmentID) AS Total_Appointments,
    SUM(s.Cost) AS Total_Billed
FROM Appointment fa
JOIN Payer pr ON fa.PayerID = pr.PayerID
JOIN Service s ON fa.ServiceID = s.ServiceID
GROUP BY pr.Payer_Name, pr.Payer_Type;
```

Columns included:
- Payer Name
- Payer Type
- Total Appointments
- Total Billed

RESULT

Analysis examples:

-Identify payer contribution to revenue.

-Track appointment volume by payer type.

-Analyze billing trends for financial planning.

Payer_Name	Payer_Type	Total_Appointments	Total_Billed
Goverment	Public	4	510.00
Self-Payment	Private	4	550.00
Alberta_Blue_Cross	Insurance	4	670.00
Sunlife	Insurance	4	750.00
Canada_Life	Insurance	4	800.00

VIEW 5: Appointment Status Summary

Purpose / analysis: Summarizes the total number of appointments by status.
Sources Tables: Appointment, Status.

```
CREATE VIEW vw_AppointmentStatusSummary AS
SELECT
    st.Status_Name,
    COUNT(fa.AppointmentID) AS Total_Appointments
FROM Appointment fa
JOIN Status st ON fa.StatusID = st.StatusID
GROUP BY st.Status_Name;
```

Columns included:
- status Name
- total Appointments

RESULT

Analysis examples:
-Monitor the number of scheduled, completed, cancelled, and no-show appointments.
-Identify bottlenecks or issues in patient attendance.
-Support operational efficiency analysis.

Status_Name	Total_Appointments
Scheduled	7
Completed	6
Cancelled	4
No-Show	3

8. Results and Implications

The system supports both operational efficiency and strategic decision-making:

- Operational Benefits: Better appointment tracking, reduced errors, optimized staff schedules.
- Financial Insights: Clear visibility in service profitability and payer contributions.
- Patient Care: Enhanced ability to review treatment histories and monitor patient adherence.
- Compliance: Maintains accountability through structured and auditable records.

9. Conclusion

This healthcare database model successfully addresses the challenges of managing patient records, staff information, and financial transactions in a healthcare clinic. By normalizing data and providing advanced analytical views, the system ensures high data integrity, efficient operations, and valuable insights for decision-making.

It not only supports day-to-day clinic management but also lays the foundation for future Electronic Health Record (EHR) integration, ensuring scalability and adaptability as healthcare needs evolve.