Telemedicine Integrated Online Pharmacy (SQL)

HINF 6220: Database Design and Security

Kaustubh Dilip Pachpande

Professor Jamon Foster

Dec 13, 2023

I. SCENARIO

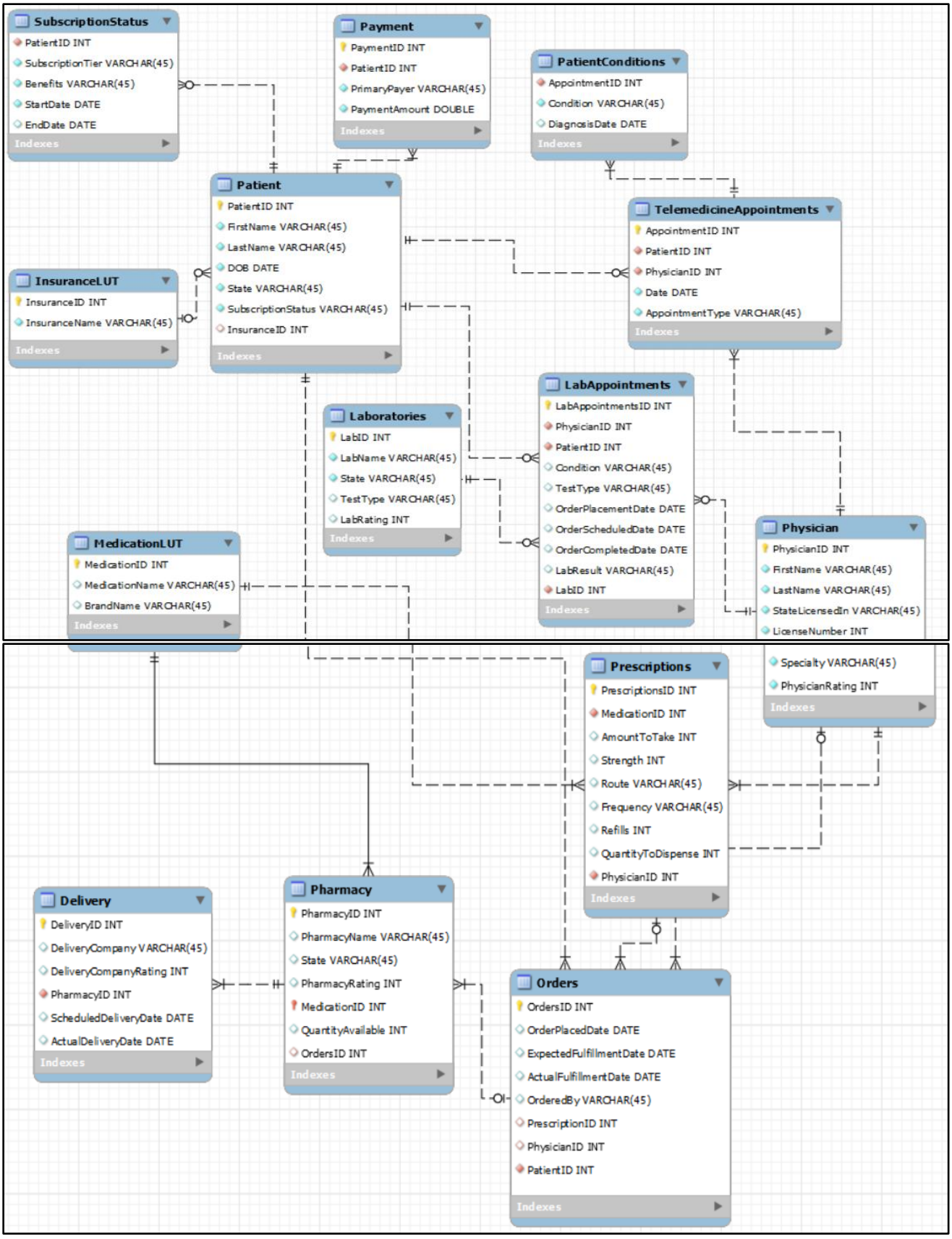
This database was designed for a telemedicine-based online healthcare platform, providing seamless virtual consultations, digital prescriptions, and at-home medication delivery. The system enables efficient management of patient records, physician interactions, and prescription processing, ensuring a smooth and secure healthcare experience.

Patients can:

- Choose a subscription plan to unlock various healthcare benefits.
- Book virtual consultations with licensed physicians via video chat, call, or text.
- Receive lab test orders and access results within the platform.
- Obtain digital prescriptions, with medications conveniently delivered to their doorstep.

The database tracks patient details, physician schedules, appointments, prescriptions, and subscription plans, ensuring optimized healthcare delivery and operational efficiency.

II. MODEL WALKTHROUGH


SubscriptionStatus
PatientID INT
SubscriptionTier VARCHAR(45)
Benefits VARCHAR(45)
StartDate DATE
EndDate DATE
Indexes
Payment
PaymentID INT
PatientID INT
PrimaryPayer VARCHAR(45)
PaymentAmount DOUBLE
Indexes
PatientConditions
AppointmentID INT
Condition VARCHAR(45)
DiagnosisDate DATE
Indexes
Patient
PatientID INT
FirstName VARCHAR(45)
LastName VARCHAR(45)
DOB DATE
State VARCHAR(45)
SubscriptionStatus VARCHAR(45)
InsuranceID INT
Indexes
TelemedicineAppointments
AppointmentID INT
PatientID INT
PhysicianID INT
Date DATE
AppointmentType VARCHAR(45)
Indexes
InsuranceLUT
InsuranceID INT
InsuranceName VARCHAR(45)
Indexes
LabAppointments
LabAppointmentsID INT
PhysicianID INT
PatientID INT
Condition VARCHAR(45)
TestType VARCHAR(45)
OrderPlacementDate DATE
OrderScheduledDate DATE
OrderCompletedDate DATE
LabResult VARCHAR(45)
LabID INT
Indexes
Laboratories
LabID INT
LabName VARCHAR(45)
State VARCHAR(45)
TestType VARCHAR(45)
LabRating INT
Indexes
Physician
PhysicianID INT
FirstName VARCHAR(45)
LastName VARCHAR(45)
StateLicensedIn VARCHAR(45)
LicenseNumber INT
MedicationLUT
MedicationID INT
MedicationName VARCHAR(45)
BrandName VARCHAR(45)
Indexes
Specialty VARCHAR(45)
PhysicianRating INT
Indexes
Prescriptions
PrescriptionsID INT
MedicationID INT
AmountToTake INT
Strength INT
Route VARCHAR(45)
Frequency VARCHAR(45)
Refills INT
QuantityToDispense INT
PhysicianID INT
Indexes
Delivery
DeliveryID INT
DeliveryCompany VARCHAR(45)
DeliveryCompanyRating INT
PharmacyID INT
ScheduledDeliveryDate DATE
ActualDeliveryDate DATE
Indexes
Pharmacy
PharmacyID INT
PharmacyName VARCHAR(45)
State VARCHAR(45)
PharmacyRating INT
MedicationID INT
QuantityAvailable INT
OrdersID INT
Indexes
Orders
OrdersID INT
OrderPlacedDate DATE
ExpectedFulfillmentDate DATE
ActualFulfillmentDate DATE
OrderedBy VARCHAR(45)
PrescriptionID INT
PhysicianID INT
PatientID INT
Indexes

a. The Central Event

The central event of this database model is the **telemedicine appointments** between a patient and a physician. This consultation serves as the primary interaction within the system, connecting patient records, physician schedules, prescription management, and subscription plans. It is the focal point around which other functionalities—such as prescription issuance, lab test orders, and medication delivery—are dependent on.

b. Model Walkthrough

1. Patient Information: We begin with the "Patient" entity, which stores key patient details. Some patients may have subscriptions ("SubscriptionStatus") or insurance information ("InsuranceUT").

2. Physician Interaction: Patients interact with physicians, who are identified by their specialty and rating. This interaction involves telemedicine appointments ("TelemedicineAppointments"), based on which the physician orders lab appointments ("LabAppointments") to diagnose patient conditions ("PatientConditions").

3. Prescriptions: Based on diagnosis, physicians write prescriptions ("Prescriptions"). Each prescription includes details about the medication, dosage, and refills.

4. Orders and Fulfillment: Prescriptions lead to orders ("Orders"), which are tracked with expected and actual fulfillment dates. Orders are associated with both the prescribing physician and the patient.

5. Pharmacy and Delivery: Pharmacies ("Pharmacy") fulfill orders and manage medication inventory. Finally, the medication is delivered to the patient ("Delivery"), completing the process.

c. Specializations included (supertype/subtype)

Partial Specialization:

- Supertype: "Patient"
- Subtypes: "SubscriptionStatus" and "InsuranceUT"
- This means that not all patients are required to have a subscription status or insurance information. Some patients may have one, both, or neither.
- Completeness Constraint: Partial (not explicitly shown in the diagram)
- Disjointness Constraint: Overlapping (not explicitly shown in the diagram)
    - This means a patient can have both a subscription and insurance information.

Explanation:
The "Patient" entity is the supertype, and it has two subtypes: "SubscriptionStatus" and "InsuranceUT." This indicates that some patients might have specific attributes related to their subscription status or insurance information. However, not all patients will have these attributes, which is why it's a partial specialization.

d. The Limitation

1. Our database is designed in a way that it only contains structured data whereas in real world applications there are attributes like physician notes in unstructured format which our database cannot capture.
2. We have not included timestamps in our records and this could limit the ability to analyze trends over time and track changes.
3. Our model does not consider mechanisms for obtaining patient consent for data usage and adhere to ethical standards regarding data privacy and security.

IV. REPORT QUERIES & DESCRIPTIONS

Report 1: Seasonal Trends (see below for query)

What conditions were diagnosed in fall?

This analysis helps identify seasonal trends in patient diagnoses, enabling proactive healthcare measures. For instance, if flu cases peak in the fall, targeted awareness campaigns can be launched, such as promoting flu vaccinations. Additionally, understanding these patterns allows for better inventory management, ensuring essential medications and resources are adequately stocked.

```
use nthakkar;
-- What, if any, seasonal trends can be identified in conditions diagnosed in fall?
SELECT
    p.firstname FirstName,
    p.lastname LastName,
    pc.condition ConditionDiagnosed,
    pc.diagnosisdate DiagnosisDate
FROM patient p
JOIN telemedicineappointments ta
ON p.patientid = ta.patientid
JOIN patientconditions pc
ON pc.appointmentid = ta.appointmentid
WHERE pc.diagnosisdate BETWEEN '2023-09-01' AND '2023-11-30';
```

esult Grid | Filter Rows: | Export: | Wrap Cell Content:

FirstName	LastName	ConditionDiagnosed	DiagnosisDate
Hailey	Baldwin	Flu	2023-11-15
Justin	Bieber	Flu	2023-10-17

Report 2: Subscription Tier (see below for query)

How many patients are subscribed to each tier?

This helps determine the most popular subscription tier on the platform, providing valuable insights into user preferences. By identifying which tiers attract the most patients, the platform can refine its marketing strategies, optimize pricing models, and enhance features that drive engagement. Additionally, understanding subscription distribution aids in resource allocation, ensuring that services are tailored to meet the needs of different user segments.

```sql
-- What is the preffered subscription tier among patients?

SELECT
    ss.SubscriptionTier,
    COUNT(p.PatientID) 'No of subscribers per tier'
FROM patient p
JOIN subscriptionstatus ss
ON p.PatientID = ss.PatientID
GROUP BY ss.SubscriptionTier;
```

Result Grid | Filter Rows: | Export: | Wrap Cell Content:

SubscriptionTier	No of subscribers per tier
Silver	4
Gold	3
Platinum	1

Report 3: Insurance and Payment (see below for query)

What is the percentage of active subscribers whose primary payer is insurance?

This helps assess the reliance on insurance coverage among active subscribers, providing insights into payer distribution. Understanding this percentage allows for better pricing strategies, partnerships with insurers, and targeted marketing efforts to improve accessibility and retention.

```sql
-- Identify patients with active subscriptions and determine the
-- percentage of people paying through insurance.

SELECT
    ROUND(COUNT(pm.primarypayer)/(select count(*) from payment) * 100,2) as 'Percentage of active insurance pay
FROM patient p
JOIN payment pm
ON pm.patientid = p.patientid
JOIN insurancelut inlut
ON inlut.insuranceid = p.insuranceid
WHERE p.subscriptionstatus = 'active'
AND pm.primarypayer = 'insurance'
```

Result Grid | Filter Rows: | Export: | Wrap Cell Content:

Percentage of active insurance payers
50.00

Report 4: Inventory (see below for query)

What is the current stock of each medication at each pharmacy after current orders are fulfilled?

This helps monitor medication inventory levels across pharmacies, ensuring stock availability, preventing shortages, and optimizing restocking strategies.

```
13      -- Determine the stock of medicines with each pharamcy after current orders are fulfilled.
14
15  •   SELECT
16        mlut.MedicationName,
17        py.PharmacyName,
18        py.MedicationID,
19        (SUM(py.QuantityAvailable) - SUM(pr.QuantityToDispense)) 'Available Inventory'
20      FROM pharmacy py
21      JOIN prescriptions pr
22      ON pr.MedicationID=py.MedicationID
23      JOIN medicationlut mlut
24      ON mlut.MedicationID=pr.MedicationID
25      GROUP BY py.MedicationID, py.PharmacyName
26      ORDER BY (SUM(py.QuantityAvailable) - SUM(pr.QuantityToDispense)) DESC;
27
```

Result Grid | Filter Rows: | Export: | Wrap Cell Content:

MedicationName	PharmacyName	MedicationID	Available Inventory
Paracetamol	Cigna	3002	240
AdvilProMax	CVS	3005	230
Paracetamol	CVS	3002	180
Peptobismol	CVS	3004	141
Betablocers	Walgreens	3001	140
Procrit	Walgreens	3003	109

Report 5: Patient Compliance (see below for query)

How many patients are not following up with their scheduled lab appointments?

This helps identify gaps in patient adherence to lab appointments, enabling targeted follow-up strategies, automated reminders, and improved patient engagement to enhance overall care continuity and diagnostic accuracy.

```
-- Determine the number of patients not following up with their
-- scheduled lab appointments and determine if there's any correlation
-- with the lab rating.

SELECT
    p.patientid PatientID,
    p.firstname FirstName,
    p.lastname LastName,
    la.condition PatientCondition,
    lab.labname LabName,
    lab.labrating LabRating
FROM patient p
JOIN labappointments la
ON la.patientid = p.patientid
JOIN laboratories lab
ON lab.labid = la.labid
WHERE (la.ordercompleteddate is NULL)
AND (la.labresult = 'No show');
```

Result Grid | Filter Rows: | Export: | Wrap Cell Content:

PatientID	FirstName	LastName	PatientCondition	LabName	LabRating
3	John	Wick	Hypertension	BloodPros	2

Report 6: Pharmacy Order Fulfillment (see below for query)

Are there any delays in medication order fulfillment for each pharmacy?

This helps track pharmacy performance by identifying delays in medication order fulfillment, allowing for proactive inventory management, process optimization, and improved patient satisfaction.

```
73    -- Determine any delays in order fulfillment for each pharmacy, if present.
74
75    SELECT
76        py.pharmacyname AS PharmacyName,
77        mlut.medicationname AS MedicationName,
78        CASE WHEN
79        DATEDIFF(od.actualfulfillmentdate, od.expectedfulfillmentdate) = 0
80        THEN 'OnTime'
81        ELSE 'Late'
82        END AS 'OrderFulfillmentStatus',
83        py.pharmacyrating AS PharmacyRating
84    FROM pharmacy py
85    JOIN orders od
86    ON od.ordersid = py.ordersid
87    JOIN medicationlut mlut
88    ON mlut.medicationid= py.medicationid;
89
```

Result Grid | Filter Rows: | Export: | Wrap Cell Content:

PharmacyName	MedicationName	OrderFulfillmentStatus	PharmacyRating
CVS	Paracetamol	OnTime	4
CVS	AdvilProMax	Late	4
Walgreens	Betablocers	Late	5
Walgreens	Procrit	OnTime	5

Report 7: Physician Rating (see below for query)

What is the average rating of primary care physicians?

This report calculates the average rating of primary care physicians, helping assess patient satisfaction, identify top-performing providers, and highlight areas for improvement in healthcare services.

```
2     -- Identify the average ratings of primary care physicians.
3
4     SELECT
5        ROUND(AVG(physicianrating),2) 'Avg Physician Rating'
6     from physician
7     where specialty = 'Primary care';
8
```

ult Grid | Filter Rows: | Export: | Wrap Cell Content:

Avg Physician Rating
4.33

Report 8: Preferred Appointment Type (see below for query)

What is the preferred appointment type (Call/Videocall/Text) among patients?

This report analyzes the preferred appointment type (Call/Videocall/Text) among patients, providing insights into patient preferences and helping optimize scheduling strategies and service offerings.

```
3      -- Find preferred method of appointment
4
5  •   SELECT
6          tm.appointmenttype 'AppointmentType',
7          COUNT(tm.appointmenttype) 'Count'
8      FROM physician ph
9      JOIN telemedicineappointments tm
10     ON tm.PhysicianID = ph.PhysicianID
11     GROUP BY tm.Appointmenttype;
12
13
14
15
16
17
```

esult Grid | Filter Rows: | Export:

AppointmentType	Count
Videocall	2
Text	2
Call	3