Technical Report

**Project title: Real Housewives of Beverly Pills**

IST 659 Data Admin Concepts & Db Mgmt

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Table of Contents

[Introduction 3](#_Toc167651661)

[Business Needs: 4](#_Toc167651662)

[Project Goal/Objectives: 4](#_Toc167651663)

[Project Scope: 4](#_Toc167651664)

[Glossary: 5](#_Toc167651665)

[Specific business rules: 6](#_Toc167651666)

[Data analysis of the facts listing entities, attributes, and relationships in the data model. 7](#_Toc167651667)

[Conceptual data model diagram. 10](#_Toc167651668)

[Logical data model diagram. 11](#_Toc167651669)

[Identification of your external data model and data logic. 12](#_Toc167651670)

[SQL up/down script 13](#_Toc167651671)

[Conclusion 14](#_Toc167651672)

# Introduction

In today's dynamic healthcare landscape, efficient management of pharmaceutical businesses is paramount to ensuring seamless operations, optimal inventory control, and superior patient care. With the rapid evolution of technology, the need for robust database management systems tailored to the unique requirements of pharmacy businesses has become increasingly evident. Creating a comprehensive database capable of managing various facets of pharmacy operations, including inventory, orders, drugs, insurance, and patient information, emerges as a critical solution to address these evolving needs.

This technical report aims to outline the development and implementation of a database management system designed specifically for the pharmacy business domain. This project focuses on leveraging advanced database technologies to streamline and enhance key aspects of pharmacy management, ultimately contributing to improved operational efficiency, cost-effectiveness, and customer satisfaction.

Through meticulous analysis of the pharmacy business processes and requirements, coupled with modern database design principles and methodologies, this project endeavors to deliver a comprehensive solution that caters to the diverse needs of pharmacy stakeholders. By centralizing data management and automating routine tasks, the proposed database system seeks to empower pharmacy professionals with the tools to make informed decisions, optimize resource utilization, and deliver superior patient care experiences.

Throughout this technical report, we will delve into the details of database design, implementation strategies, and the functionalities offered by the proposed pharmacy management system. Additionally, we will explore the potential benefits, challenges, and prospects associated with adopting such a database solution in the pharmacy industry. We believe this project can serve as a valuable resource for pharmacy businesses seeking to harness the power of data-driven insights to thrive in an increasingly competitive and demanding healthcare landscape.

# Business Needs:

The Pharmacy needs a robust, user-friendly, and efficient database that enhances the overall operations and service of the pharmacy business by tracking orders, patients, inventory, payment, costs, and insurance providers so that they can maintain profitable inventory levels and ensure payment.

# Project Goal/Objectives:

The main objectives of this project are listed below:

* Designing a Relational Database Schema: Develop a comprehensive and efficient relational database schema for the pharmacy business operations, including inventory management, order processing, and patient information.
* Implementing Data Integrity Measures: Ensure the integrity of the pharmacy database by implementing constraints, such as primary keys, foreign keys, unique constraints, and check constraints, to maintain data accuracy and consistency.
* Integrating Inventory Management: Design and implement functionalities to manage inventory efficiently, including tracking stock levels and facilitating automatic reordering processes.
* Managing Patient Information: Create modules to manage patient information securely, including storing patient demographics, prescription records, and communication options, while ensuring compliance with privacy regulations.
* Enabling Reporting and Analytics: Build capabilities to generate comprehensive reports and perform data analytics to gain insights into pharmacy operations, including sales performance analysis, inventory turnover rates, customer demographics, and prescription trends.

# Project Scope:

The project will include insurance companies, drugs, drug inventory, orders, customers, and insurance companies. Additional store inventory, order management processes, and physician tracking are out of scope.

# Glossary:

|  |  |
| --- | --- |
| Patient\_dob | Date of birth of the patients |
| Patient\_ssn | Social Security Number of the patients |
| insurance | Refer to health insurance which is a contract taken out to cover the cost of medical care. |
| Insurance\_copay | Fixed amount that an insured person pays for covered medications |
| Insurance\_coverage\_amount | Amount of money covered for an individual or entity by way of insurance services. |
| Orders | Order placed to the pharmacy by a given patient |
| Order\_item\_quantity | Quantity of item included in the same order |
| Order\_cost | Total price for an order after sum all the item prices. |
| Coverage\_amount | Amount of money of the item price covered by the insurance |
| Drug\_pack\_quantity | Quantity per pack of medication. |
| Drug\_generic\_indicator | Identify whether any specific drug is generic |
| Drug\_otc\_indicator | Identify whether any specific drug can be obtained over the counter. |
| Drug\_primary\_use | Main illness treated by a drug. |

# Specific business rules:

* Risks and Issues:

Sensitive information (HIPAA) will be handled, therefore, there is a risk associated and measures should be taken to ensure proper information protection.

Since the database will include multiple codes for drugs and patients with a large scope, there is a risk associated with incorrectly coded drugs, incorrect insurance information, and wrong dosage captured.

* Assumptions:

The pharmacy would use this to track inventory, patient activity, and revenue.

The data would be frequently updated and maintained.

* Data requirements:

The insurance information should contain copay information, insurance types, and company names.

The insurance type should be restricted to predetermined categories.

Drug information should be included, such as name, code, type, dosage, quantity, pricing, and uses.

Inventory should contain product expiration, availability, and quantity on hand.

The pharmacy should include the name of the pharmacy, accepted insurance providers, location number, and specialized treatment information.

There should be patient information such as insurance, date of birth, email, and phone number.

There should be recorded order information that includes the order number, date filled, insurance used (if any), cost, drug code, and the next available date the prescription can be filled.

# Data analysis of the facts listing entities, attributes, and relationships in the data model.

The following entities, attributes, and relationships were identified as part of the data analysis for the creation of the database. This data model is designed to efficiently manage various aspects of pharmacy operations, including patient management, prescription fulfillment, inventory tracking, and insurance billing.

1. Patient:

* Attributes:

+ patient\_name [RC]  
+ patient\_address [MC]

+ patient\_DOB [R]

+ patient\_email [RU]

+ patient\_phone\_number [R]

+ patient\_ssn [RU]

1. Pharmacy:

* Attributes:

+ pharmacy\_name [R]

+ pharmacy\_location\_number [RU]

+ pharmacy\_location\_address [RC]

1. Orders:

* Attributes:

+ order\_number [RU]  
+ order\_item\_count [R]

+ order\_date\_filled [R]

1. Orders Item Detail

+ order\_item\_number [R]  
+ order\_date\_filled [R]

+ order\_item\_quantity [R]

+ order\_item\_cost [R]

1. Insurance

* Attributes:

+ insurance\_name [R]  
+ insurance\_type [RC]  
+ insurance\_copay [R]

1. Insurance\_Type:

* Attributes:

+ insurance\_type\_code [RU]  
+ insurance\_type\_description [RU]

1. Drug:

* Attributes:

+ drug\_name [R]  
+ drug\_code [R]  
+ drug\_type [R]

+ drug\_dosage [R]

+ drug\_pack\_quantity

+ drug\_generic\_indicator

+ drug\_otc\_indicator

+ drug\_price [R]

+ drug\_uses

1. Inventory:

* Attributes:

+ inventory\_quantity [R]  
+ inventory\_location

+ inventory\_item\_cost

+ inventory\_available\_indicator

+ inventory\_expiration

Relationships:

Each *Patient* can place multiple *Orders* but each *Order* can be placed by only one *Patient*.

Each *Patient* will be assigned to one *Pharmacy* while each *Pharmacy* will have many *Patients*.

Each *Patient* owns one *Insurance*. Each *Insurance* will be owned by multiple *Patients*.

Each *Pharmacy* can receive multiple *Orders* and each *Order* will be sent to only one *Pharmacy*.

Each *Insurance* belongs to an *Insurance type* while each *Insurance type* can be associated with multiple *Insurance* records.

Each *Drug* can be included in multiple *Orders*. In the same way, each *Order* can have multiple *Drugs*.

Each *Drug* will have one Inventory and the inventory consists of several *Drugs*.

These entities, attributes, and relationships form the data model designed to manage the complex operations of a pharmacy business. By accurately capturing relationships such as Patients' connections to Pharmacies and Insurance, the model supports efficient management of patient records, prescription orders, and billing processes. Furthermore, the inclusion of detailed Inventory tracking and high inventory to track excess stock and holding costs ensures that the pharmacy can maintain adequate stock levels and manage expiration dates, thus preventing stockouts and ensuring timely fulfillment of prescriptions. This robust data model is crucial for streamlining pharmacy operations, improving patient care, and optimizing resource utilization.

# Conceptual data model diagram.

The conceptual model is a crucial step in our data analysis and database creation providing a clear and structured representation of the key entities, attributes, and relationships between them, and showing how the model will support the pharmacy business. The following diagram of the conceptual model identifies the key attributes and illustrate their relationships.

A black and white screen shot of a black background

Description automatically generated

# Logical data model diagram.

The diagram presented below corresponds to the logical model developed as a detailed blueprint that outlines the structure of our database, specifying the tables, columns, data types, and relationships required to manage pharmacy operations effectively. This model ensures the data is organized efficiently, supporting robust data management and retrieval processes.

A screenshot of a computer screen

Description automatically generated

# SQL up/down script

The "Real Housewives of Beverly Pills" pharmacy project involved developing and implementing a comprehensive SQL up/down script to manage the database structure and data based on the conceptual and logical model previously presented.

Refer to the “ pharmacy.sql” file for detailed up scripts for applying changes, including table creation, attribute addition, and relationship definitions, and the corresponding down scripts for reverting changes, ensuring the ability to roll back to previous states if necessary.

# External Data Model

The external data model for the "Real Housewives of Beverly Pills" pharmacy database project represents a high-level view of the data from the perspective of end-users. It focuses on what data is stored and how it is logically organized, ensuring that the database meets user requirements and business needs.

We used Power BI as a tool to visualize and analyze data from the external data model of the "Real Housewives of Beverly Pills" pharmacy database. Data from key entities such as Patients, Orders, and Inventory were imported into Power BI using a dynamic table. Relationships between these entities were maintained to provide comprehensive and cohesive reports.

Refer to the following screenshot for the Power BI model developed for our application.

A screenshot of a computer screen

Description automatically generated

When designing the Power BI dashboard, we included five tabs that connected to our database: Summary, Inventory, Pharmacy Orders, Order Details, and Patient Database. Each tab is designed to present key information from an end-user perspective.

To enhance user interaction and interpretation, we incorporated filters and calculated fields to summarize data on sales, orders, items, drugs, and patients. Additionally, we added pie charts, bar charts, and other graphical elements to visually represent the data, making it easier for users to understand and engage with the information.

# Data Logic

The data logic involved the rules, constraints, and processes applied to the data to ensure it is accurate, consistent, and meaningful. For the pharmacy database, this included:

1. **Validation Rules:** E.g: Ensuring patient emails and SSNs are unique. Verifying that drug prices and inventory quantities are non-negative. Validating that order dates are within a reasonable range (not in the future).
2. **Constraints:** E.g: Primary keys for unique identification of records (e.g., patient\_id, pharmacy\_id, order\_id). Foreign keys to enforce referential integrity between related tables. Unique constraints on fields like patient\_email.
3. **Triggers:** E.g : Automatically updating inventory quantities when orders are placed or canceled. Generating alerts for low inventory levels to ensure timely restocking.
4. **Stored Procedures:** E.g: Procedures for placing orders, updating patient information, and processing insurance claims. Functions to calculate order totals and determine copay amounts based on insurance type.
5. **Indexes:** E.g: Indexes on fields commonly searched from tables like order details to improve query performance.
6. **Views**: E.g: Create table views such as v\_drugs, v\_patients, v\_patient\_address, v\_patient\_address\_lookup, v\_insurance, v\_patient\_insurance\_lookup, v\_insurance\_type, v\_inventory, V\_orders, v\_order\_item\_details, v\_pharmacies, v\_pharmacy\_address, v\_pharmacy\_address\_lookup.
7. **Data Relationships:** E.g : One-to-many relationships between patients and orders, pharmacies and patients, orders and order item details. Many-to-many relationships between drugs and orders, resolved through the order\_item\_details table.
8. **Power BI:** Power BI was a tool to visualize and analyze data from the external data model given the "Real Housewives of Beverly Pills" pharmacy database a high-level view of the data from the perspective of end-users.

By carefully designing the external data model and implementing robust data logic, the pharmacy database ensures efficient, reliable, and secure management of critical pharmaceutical data, supporting the business operations and strategic objectives of the "Real Housewives of Beverly Pills" pharmacy.

# Conclusion

As we delved into the details of database design, implementation strategies, and the functionalities of the proposed pharmacy management system, it became clear that centralized data management and automation of routine tasks are essential for driving positive outcomes in pharmacy operations.

This project aimed to streamline key aspects of pharmacy management and empower professionals with the tools necessary to navigate the complexities of modern healthcare by addressing the evolving needs of pharmacy stakeholders through database technologies.

Through meticulous analysis and consideration of pharmacy business processes and requirements, we are confident that this project will offer valuable insights and solutions for pharmacy businesses looking to leverage data-driven approaches for success.

We develop a comprehensive and efficient relational database schema for the pharmacy business operations, including inventory management, order processing, and patient information. Implemented Data Integrity Measures ensuring the integrity of the pharmacy database through constraints, such as primary keys, foreign keys, unique constraints, and check constraints, to maintain data accuracy and consistency.

Additionally, we designed and implemented functionalities to manage inventory efficiently, including tracking stock levels and facilitating automatic reordering processes, and created modules to manage patient information securely. Also, we built capabilities to generate comprehensive reports and perform data analytics to gain insights into pharmacy operations, including sales performance analysis, inventory turnover rates, customer demographics, and prescription trends.

In conclusion, the development and implementation of the Real Housewives of Beverly Pills database management system tailored to the pharmacy business domain representing a crucial step towards enhancing operational efficiency, cost-effectiveness, and customer satisfaction within the pharmaceutical industry.

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# Next Steps for Future Iterations:

* Tracking Orders by Customers, Especially on Pain Medications:

Implementing detailed tracking mechanisms to monitor the dispensing of controlled substances, particularly pain medications, to ensure compliance with regulatory requirements and to identify any potential abuse patterns.

* Enhanced Inventory Tracking:

Adding more sophisticated inventory tracking features, such as real-time inventory updates, batch tracking, and expiration date monitoring to further improve inventory management and reduce waste.

* Incorporating Physician Information:

Expanding the database to include detailed physician information, allowing for better coordination and communication between pharmacies and prescribing doctors, and ensuring prescriptions are accurately fulfilled.

* Advanced Analytics and Reporting:

Introducing advanced data analytics capabilities to provide deeper insights into pharmacy operations, including predictive analytics for inventory needs, customer behavior analysis, and performance benchmarking.

* Integration with Other Healthcare Systems:

Exploring the integration of the pharmacy management system with other healthcare systems, such as electronic health records (EHRs) and insurance platforms, to create a more seamless healthcare experience for patients.

* Mobile Application Development:

Developing a mobile application for patients and pharmacy staff to improve accessibility and convenience, enabling features like prescription refills, order tracking, and inventory management on the go.

By focusing on these future enhancements, we aim to continuously improve the Real Housewives of Beverly Pills pharmacy management system, ensuring it meets the evolving needs of the pharmacy industry and provides maximum value to its users.