

Prescription Drugs Insurance Database

Requirement Analysis

Introduction

Purpose

This application aims to use a database structure to optimize the sales revenue of a medical insurance company by analysing its different business aspects such as its customers' profile, the most popular insurance plans as well as selecting potential partnerships with pharmaceutical manufacturers and health practitioners, and identifying current and future market gaps by analysing the companies' prescription drug coverages.

The database can also be used of course to keep a record of all the transactions and claim origins of any client allowing to justify any reimbursements and reducing fraud.

Scope and Special Requirements

Every health insurance plan comes with a prescription drug coverage. We decided to model a database systems that keep track of the the plan usage by our clients as well as the relationships that the clients share with the insurance medical partners

Terminology

No terminology required

Inspirations

- <https://www.soa.org/essays-monographs/group-med-large-claims-coll-analysis/>
- <https://www.lacapitale.com/en/individuals/insurances/group-insurance/prescription-drug-medical>
- <http://www.ramq.gouv.qc.ca/en/citizens/prescription-drug-insurance/Pages/description.aspx>

Database Description

Entities and their attributes

The following entities will be stored in the tables of the relational database:

InsurancePlans: An insurance plan represents the different prescription drug coverages that a client can choose when subscribing to our medical insurance company. It is associated with information on the plan coverage and its price. Its primary key is *planID*. It must also cover at least one drug in order to exist.

Clients: A client must subscribe to at least one insurance plan. It is identified through its *cid* and the database stores its address, phone number and email. A client can only be one of Companies or Individuals.

Companies: A company is a corporation that subscribes to our group insurance plans for their employees. A company has a company name and a number of employees and is identified by their unique *uid*.

Individuals: An individual is a person who subscribes on their own to at least one health insurance plan. An individual is identified by their unique *uid* and has a first name, a last name, a gender and a date of birth.

HealthPractitioners: A health practitioner is a registered medical agent that either works in a health facility in partnership with our insurance company or has an individual partnership with us. It is the only entity that can provide a Prescription to a Client to purchase drugs from a pharmacist. The database keeps track of the practitioner's first and last name, work phone number, work email and specialization (e.g. doctor, nurse, pharmacist). A practitioner is identified through its unique *dID*.

Prescriptions: A prescription given to a patient by the health practitioner contains the start date and end date of the validity of the prescription and is identified through its unique *presID*. A prescription must contain/be in a relationship with at least one pharmaceutical drug.

HealthFacilities: A health facility represents the place where registered health practitioners or pharmacists work at. We store the institution's name, the office addresses, phone number, work email as well as the institute name. A health facility is identified by its unique *fID*.

Pharmacists: Pharmacists are registered and have a contract with our insurance company to sell the pharmaceutical drugs to our clients. A pharmacist IS-A health practitioner as a pharmacist can also write prescriptions to clients. A pharmacist is identified by its unique *dID*.

Receipts: A receipt is the proof of the transaction that occurred between a pharmacist and a client when the client purchases pharmaceutical drugs. A receipt is associated with the date of the transaction, the quantity purchased by the client, and the total price paid. A receipt is identified by its unique *receiptID*.

Drugs: A prescription drug has a name, a price and a manufacturer (pharmaceutical company). A prescription drug is identified by its unique *duID*.

InsuranceClaims: An insurance claim is used to keep track of the reimbursements claimed by our clients. Each insurance claim must be associated with exactly one client, one prescription and one receipt. An insurance claim has a date and is identified by its unique *icID*.

Relationships

Subscribed: A *client* subscribes to an *insurance plan*. It is a many-to-many relationship as multiple clients can subscribe to the same insurance plan and a client can subscribe to more than one insurance plan. In order to be a client, the client must subscribe to at least one plan. It also stores the start and end date of a subscription and is uniquely identified using the *Client cid* and the *InsurancePlans planID* as keys.

Covers: A specific insurance plan covers a set of pharmaceutical drugs and is identifiable by the combination of *InsurancePlans planID* and the *Drugs duID* as keys.

Contains: A *prescription* contains *drugs*. It is a many-to-many relationship with the constraint that a prescription must contain at least one drug, otherwise there is no need for our insurance database to record it. It is identified using the combination of *Prescriptions presID* and the *Drugs duID* as keys.

WorksIn: A *health practitioner* works in a *health facility*. It is a many-to-many relationship as a doctor can work in multiple hospitals and hospitals can have more than one doctor. There are no constraints in the relationship as a doctor can be an independent doctor and have no office. The combination of *HealthPractitioner dID* and *HealthFacilities fID* serve as keys.

IsLinked: A *receipt* is linked to *drugs*. It is a many-to-many relationship with the constraint that a receipt must contain at least one drug for a transaction to occur.

Reimbursed: An *insurance plan* reimburses the *client* based on its *coverage*. It has a date and an amount to keep track of how much was paid back to the client.

Prescribed: A *prescription* is prescribed by exactly one *health practitioner* to exactly one *client*. There is a participation constraint and a key constraint for each prescription so that each prescription is unique when being prescribed to a pair of health practitioner and client in the ternary relationship.

Claimed: An *insurance claim* is claimed by a *client* given the *prescriptions* and the *receipts* of purchase. There is a participation constraint and a key constraint so that each entry must be of exactly one *insurance claim* for a tuple of *receipts*, *prescriptions*, and *clients*.

Sold: A transaction is valid only if there exists a *receipt* for the drugs sold by the *pharmacist* to the *client*. There is a participation constraint and key constraint for each *receipt* so that a receipt is exactly one transaction between the pair of *client* and *pharmacist*. The relationship is implemented in the *Receipts* table.

Application Description

Overview

Our database aims to be used by medical insurance companies that needs to optimize their profitability. It allows medical insurance companies to offer to their partners the best medical insurance plans to be sold as individual insurance plan or group insurance plan. Each plan's coverage is determined by the most demanded prescription drugs coverage within a geographical regions and the most popular plans selected by clients according to their profiles and the number of claims they make (less claims by clients results in less expenses for the medical insurance company, thus more net profit).

Preliminary Calculations

Average revenue per plan is the gathered amount of money reimbursed to clients minus the number of subscribers times its price divided by the number of subscribers.

Algorithm Description

- InsurancePlans' **future coverage and price**: by calculating the average revenue per plan using claims we can make predictions on which plans to keep and which plans to update.
- **Identify new demands**: by crossing the InsurancePlans with Prescriptions data and comparing what are the most purchased yet least covered prescription drugs, by allowing the company to adapt to changes in the market by providing new InsurancePlans, by satisfying the demand at the right price by predicting the drug prices, prescriptions data and the average cost per potential client for that new plan.
- **HealthPractitioners and/or HealthFacilities future partnerships**: based on the quantity of prescriptions made by a specific type of practitioners, the medical insurance company can decide if it needs more partners in the same geographical area by selecting the addresses of the health facilities, or by crossing the data with other health practitioners with the same specialization, as well as identifying any negative partnerships.
- **Future drugs negotiations**: by retrieving from the claims the most claimed drugs, the medical insurance company can efficiently decide in what negotiations to invest in, with which pharmaceutical drug manufacturers to obtain a lower prices for their clients' insurance plans.
- **Analysis on claims by gender, age and prescription**: by crossing data from clients and insurance plans along with claims, we can identify which client profile is the most profitable and least profitable for the company and adapt the plans accordingly.

Appendix

A list of the pharmaceutical drugs can be found on the following page:

<https://www.canada.ca/en/health-canada/services/drugs-health-products/drug-products/prescription-drug-list/list.html>

A list of health practitioners' specializations are defined by the following page:

<https://www.cma.ca/En/Pages/specialty-profiles.aspx>

Relations

Entities

InsurancePlans(planID,coverage,price,pName)

Clients(cID,fName,lName,email,phone,gender,address,birthdate,bankDetails)

Companies(cID,compName,numEmploy) cID foreign key referencing Clients

Individuals(cID,gender,fName,lName,birthdate) cID foreign key referencing Clients

HealthPractitioners(dID,fName,lName,specialization,pNumber,email)

Prescriptions(presID,startDate,endDate)

HealthFacilities(fID,hName,address,type,pNumber)

Pharmacists(dID) did is a foreign key of Healthparcticioners

Receipts(rid,cid,pID,date,totalprice) cid foreign key referencing Clients, pID foreign key referencing Pharmacists

Drugs(duID,dName,manufacturer,price)

Insuranceclaims(icID,uID,receiptID,date) cid foreign key referencing Clients, receiptID foreign key referencing Receipts

Relationships

Subscribed(planID,cid,startDate,endDate) planID foreign key referencing InsurancePlans, cid foreign key referencing Clients

Contains(presID,duID,quantity,refills) presID foreign key referencing Prescriptions, cid foreign key referencing Drugs

Dworksin(dID,fID) dID foreign key referencing HealthPractitioners, fID foreign key referencing Healthfacilities

Islinked(rid,duID,drugprice,quantity) rid foreign key referencing Receipts, duID foreign key referencing Drugs.

Rembursed(icID,planID,amount,date) icID foreign key referencing InsuranceClaims, planID foreign key referencing InsurancePlans.

Covers(planID,duID) planID foreign key referencing InsurancePlanes, duID foreign key referencing Drugs

Relational Model Analysis

Looking at the ER diagram, we do not believe that there exists a way of combining our entities as each entity is involved in at least one relationship that the others are not. A pharmacist can write a prescription but can also sell prescription drugs, a relationship that cannot exist with a doctor.