Data Management and Database Design - Project 3

**Project Topic:** Covid-19 Vaccine Rollout System

**Team Name:** Team 3

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# Database Design document:

**Problem Statement:**

After the Covid crisis, came the vaccine crisis. In countries like India and Brazil, the mismanagement of available vaccines was a bigger issue than the shortage of vaccines itself. This was primarily due to the lack of a Centralized database system for the demand and supply channels. Additionally, while there were areas that lacked an adequate amount of vials, in certain other areas, unused vials had to be disposed of at the end of the day, as the opened vial would no longer be potent the next day.

# Solution:

We propose a centralized data hub for all the suppliers, storage facilities, and health care workers with the ability to insert and retrieve vaccine availability and requirement data. We also plan on enabling logistics by finding the closest storage facility to a required vaccination center, thereby reducing logistics costs and vaccine wastage.

We propose a centralized data model for universities in Boston like Northeastern University, Harvard University, MIT, Boston University, etc. to address covid-19 vaccine rollout problems. The data model comprises 3 major components: User, Vaccination center, and Vaccine storage facility.

User: The user is a student or any member of a particular university. The user books a vaccine appointment and the user is linked to the university that is responsible for allocating the vaccination center to the user.

Vaccination center: A center in the university to vaccinate the students and faculty, procure vaccines from storage centers. Each University has its own vaccination center.

The staff obtains user details such as basic information, choice of vaccine, medical history, and immunization records. Based on the above data we can check the eligibility, type of vaccine the user has to be given.

After which the staff check for the availability of vaccines, if the vaccine is available in the inventory, the user gets vaccinated, if not the staff will raise a shipment request to the nearest vaccine storage facility.

Once the vaccines have been procured from the vaccine storage facility, the user is vaccinated with the right type of vaccine.

Vaccine Storage Facility: A single storage facility can serve multiple universities. The facility is assumed to have an abundance of vaccine stock from different manufacturers. Once the storage facility receives a shipment request from one of the vaccine centers, it would supply the required vaccine to the requested vaccine center.

Diagram

Description automatically generated

# Entity Relationship Diagram

**Graphical user interface, application

Description automatically generated**

**Document Entity and Attributes with Data types defined:**

1. User table

|  |  |  |
| --- | --- | --- |
| Column name | Data Types | Description |
| user\_id | INT | Unique ID for the user |
| First Name | VARCHAR(30) | First Name of the user |
| Last Name | VARCHAR(30) | Last Name of the User |
| Date of Birth | DATE | Date of birth of the user |
| Gender | VARCHAR(6) | Gender of the user |
| Contact\_no | INT | The contact number of the user |
| Email | VARCHAR(30) | Email address of the user |
| University\_id | VARCHAR(10) | College ID of the student or any university member |
| Address | VARCHAR(50) | Address of the user |
| Age | INT | Age of the user |
| Weight | INT | Weight of the user |
| Height | FLOAT | Height of the user |
| BMI | FLOAT | Body Mass Index of the user |
| Immunization\_id | INT | Foreign key referencing user immunization table id |
| Appointment id | INT | Foreign key referencing appointment table id |

1. University

|  |  |  |
| --- | --- | --- |
| Column name | Data Types | Description |
| university\_id | VARCHAR(10) | Unique ID of the university |
| university\_name | VARCHAR(30) | Name of the university |
| university \_address | VARCHAR(50) | Address of the university |
| vaccine\_center\_id | VARCHAR(10) | Unique ID for vaccination center |

1. Vaccine center

|  |  |  |
| --- | --- | --- |
| Column name | Data Types | Description |
| vaccine\_center\_id | VARCHAR(10) | Unique ID for vaccination center |
| center\_name | VARCHAR(30) | Name of the vaccination center |
| Available\_doses | INT | Count of vaccine doses available |
| vaccine\_center\_address | VARCHAR(50) | Address of the vaccination center |
| staff\_id | VARCHAR(10) | Unique ID of the staff member |
| shortage\_flag | BOOLEAN | YES/NO - Vaccine shortage indication |
| shortage\_qty | INT | Count of the vaccine shortage |
| vaccine\_received \_on | DATE | Vaccine received date from the storage facility |
| Vaccine\_center\_request  \_id | INT | Request id from the vaccine center |
| Vaccine\_id | INT | Foreign key referencing vaccine details table id |
| User\_id | INT | Foreign key referencing user table id |
| Immunization\_id | INT | Foreign key referencing immunization details table id |

1. Vaccine\_shipment

|  |  |  |
| --- | --- | --- |
| Column name | Data Types | Description |
| Shipment\_id | INT | Unique shipment ID |
| Vaccine\_storage\_ facility\_id | INT | Unique ID of the Storage facility |
| Vaccine\_centre\_id | INT | Unique Id of the vaccine centre |
| provider | VARCHAR(30) | Manufactures of different vaccines |
| Shipment\_quantity | INT | Quantity of the vaccine in the shipment |
| Shipment\_start\_date | DATE | Start date of the shipment |
| Shipment\_end\_date | DATE | End date of the shipment |
| Shipment\_status | VARCHAR(10) | Status of the shipment |

1. Immunization details

|  |  |  |
| --- | --- | --- |
| Column name | Data Types | Description |
| immunization\_id | INT | Unique id for immunization |
| Vaccine brand | VARCHAR(20) | The vaccine brand the patient receives |
| first\_dose\_date | TIMESTAMP | Date on which 1st dose was received |
| second\_dose\_date | TIMESTAMP | Date on which second dose was received |
| vaccination\_status | VARCHAR(15) | Status of the vaccination |
| No\_of\_doses | INT | Count of vaccine doses |
| User\_id | INT | Foreign key referencing user table id |
| Vaccine\_center\_id | VARCHAR(10) | Foreign key referencing vaccine center table id |

1. Medical history of patient:

|  |  |  |
| --- | --- | --- |
| Column name | Data Types | Description |
| User\_id | INT | Unique ID of each user |
| Respiratory\_distress | BOOLEAN | If the user has Diabetes or not. |
| Lung\_disease | BOOLEAN | If the user has High Bp or not. |
| Asthma | BOOLEAN | If the user has Low Bp or not. |
| Diabetes | BOOLEAN | If the user is allergic or not. |
| High\_blood\_pressure | BOOLEAN | If the user has high blood pressure or not |
| Pregnant | BOOLEAN | If the user is pregnant or not |
| Immuno\_compromise d\_disease | BOOLEAN | If the user has an  immunocompromised disease or not |
| Smoking | BOOLEAN | If the user smokes or not |
| Heart\_disease | BOOLEAN | If the user has heart disease or not |

7. Staff table

|  |  |  |
| --- | --- | --- |
| Column name | Data Types | Description |
| Staff\_id | INT | Unique ID of each staff |
| First\_Name | VARCHAR(20) | First Name of the staff |
| Last\_Name | VARCHAR(20) | Last Name of staff |
| Gender | VARCHAR(10) | Gender of the staff |
| Vaccine\_center\_id | INT | Unique ID of the vaccine center where this particular employee works |

1. Vaccine storage

|  |  |  |
| --- | --- | --- |
| Column name | Data Types | Description |
| Storage\_facility\_id | INT | Unique ID for the storage facility |
| Vaccine\_count | INT | Count of vaccines available |
| Vaccine\_type | VARCHAR(20) | Type of Vaccine(Pfizer,J&J,etc.) |
| Storage\_location | VARCHAR(20) | Location of the storage facility |
| Vaccine\_id | INT | Foreign key referencing vaccine details table id |
| Vaccine\_request\_id | INT | Id referencing the vaccine request |

1. Vaccine request

|  |  |  |
| --- | --- | --- |
| Column name | Data Types | Description |
| request\_id | INT | Unique vaccine request id |
| Date\_created\_on | TIMESTAMP | Vaccine request created on date |
| Request\_quantity | INT | Vaccine requested quantity from the center |
| Storage\_facility\_id | INT | Id referencing the storage facility |
| Vaccine\_center\_id | INT | Id referencing the vaccine center |

1. Appointment

|  |  |  |
| --- | --- | --- |
| Column name | Data Types | Description |
| Appointment\_id | INT | Unique appointment id |
| User\_id | INT | User id unique to a user |
| Time\_of\_appointment | TIMESTAMP | Appointment booking time |
| Date\_of\_appointment | DATE | Appointment booking |

1. Vaccine\_details:

|  |  |  |
| --- | --- | --- |
| Column name | Data Types | Description |
| Vaccine\_id | INT | Unique appointment id |
| Vaccine\_manufacturer | INT | User id unique to a user |
| Date\_of\_manufacture | TIMESTAMP | Appointment booking time |
| Expiration\_date | DATE | Appointment booking date |
| Batch\_no. | LONG INT | The batch this vaccine belongs to |
| Number\_of\_doses\_in total | INT | Total number of doses  required for the vaccine to provide full immunity |
| Vaccine\_shipment\_id | INT | The shipment request this vaccine belongs to |
| Vaccine\_storage\_facility  \_id | INT | The storage facility this vaccine belongs to |

**BUSINESS RULES:**

1. vaccine center administers vaccines to students of the university associated with the vaccine center and not to students from other universities.
2. A vaccine center administers vaccines from all manufacturers
3. A vaccine request can be created if the number of vaccines from atleast one manufacturer falls below the threshold value
4. A staff member can only be associated with a single vaccine center
5. A shipment may service requests from multiple vaccine centers provided they are within range of pincodes the vaccine storage facility services
6. It is assumed that every Vaccine storage facility distributes vaccines from all manufacturers.
7. A vaccine center is associated with only one university. A vaccine center cannot be associated with multiple universities, however a university may have more than one vaccine center
8. Vaccine requests are serviced by storage facilities based on pincode. Storage facility with the nearest pincode will service the vaccine request coming from a vaccine center
9. Shipment status may have the following values – delivered, pending, delivery failed
10. Vaccine request may have the following values- completed, processing, incomplete, failed
11. A shipment may contain multiple batches of a vaccine
12. Health information of user has Boolean values for attributes
13. Appointment status may have the following values: missed, rescheduled, completed, scheduled.
14. User is prevented from booking appointment for second dose on a date earlier than second\_dose\_due\_date.
15. A single or multiple appointments may be associated with a user based on factors such as number of vaccine doses to be considered fully vaccinated and missed or rescheduled appointments
16. Vaccination status may have the following values – unvaccinated, partially vaccinated, fully vaccinated.
17. Vaccine center staff can update vaccination status in immunization details table associated with a user
18. All users have a default vaccination status of unvaccinated before getting their first/full dose of vaccine
19. Users can report if they have any symptoms post their dose of vaccine.
20. Post vaccine dose symptoms can have the following values – severe, mild, no symptom.
21. User may have post vaccine symptoms after either one dose or both doses of vaccine or no symptoms at all.

**USER PROFILES AND ACCESS RULES/PERMISSIONS:**

**Vaccine center staff**

* Has read access to user table, user health information, vaccine center table, vaccine shipment table, appointment table, post vaccine symptoms, vaccine details table, vaccine batch information table
* Has read/write/update access to immunization details table, vaccine request table,
* Had no access to vaccine storage and shipment storage record tables

**User**

* Has read/write/update access to post vaccine symptoms table, user table, appointment table, user health information table
* Has read access to immunization details table
* Has no access to university, vaccine center, staff, vaccine storage, vaccine details, vaccine request, shipment storage record, vaccine shipment tables

**Logistics operator**

* Has read/update access to vaccine request table, vaccine shipment table, shipment storage record table
* Has read access to vaccine storage table, vaccine batch information table
* Has no access to vaccine details, staff, vaccine center, university, user, immunization details, user health information, appointment, post vaccine symptoms tables

**Vaccine storage staff**

* Has Read access to vaccine request table, vaccine batch information table
* No access to staff, vaccine center, university, user, immunization details, user health information, appointment, post vaccine symptoms table, shipment storage record tables
* Has Read/write/update access to vaccine details, vaccine shipment table
* Has Read/update access to vaccine storage table

**Admin**

Has all level access to all entities in the database.