A report on COVID Vaccine certificate Database

Normalization till 3rd Normal Form

FORE SCHOOL OF MANAGEMENT

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Term 3

Section G

COVID Vaccine certificate Database

This database tracks the citizens who are vaccinated, with which vaccine. We will also keep a record of the date of the first dose, the second dose, and the second dose duration, under government guidelines. The database will also enable users to fill their comorbidities if any, here the default will be none. After having all relevant information in one table, the table will be matched with normal forms and a subdivision of tables will be generated.

The following is a bottom-up approach where we investigate the vaccination certificates of the beneficiaries and then arrange those data into a tabular form. The initial tabular form obtained has groupings and some assumptions mentioned in the following is the first table

				assume 16 digit ID	13 digit ID							
Beneficiary Name	**Age**	**Gender**	**ID Verified**	**Unique Health ID**	**Beneficiary reference ID**	**Vaccine Name**	**Date of Dose 1**	**Next Due Date (start)**	**Next Due Date (end)**	**Vaccinated by**	**vaccinated at**	**Vaccination Status**
Athiya Sharma	56	Female	Aadhaar #8767	7564	45372	COVISHIELD	20-Mar-21	18-Jun-21	03-Jul-21	SISTER JIJA	Triton Hospital	Partially vaccinated
							Date of Dose 2					
						COVISHIELD	20-Jun-21			RAVNEET KAUR	GBSS CR PARK	Fully vaccinated

This table was further rearranged to identify what kind of groups are being formed to identify whether it satisfies the first normal form or not. Following is the obtained table

Beneficiary Name	**Age**	**Gender**	**ID Verified Name**	**Unique Health ID**	**Beneficiary reference ID**	**Dose num**	**Date**	**Vaccine Name**	**Next Due Date (start)**	**Next Due Date (end)**	**Vaccinated by**	**vaccinated at**	**Vaccination Status**
Athiya Sharma	56	Female	Aadhaar	7564	45372	Dose 1	20-Mar-21	COVISHIELD	18-Jun-21	03-Jul-21	SISTER JIJA	Triton Hospital	Partially vaccinated
						Dose 2	21-Jun-21	COVISHIELD	NA	NA	RAVNEET KAUR	GBSS CR PARK	Fully vaccinated
Rahul Gupta	32	Male	Licence	6453	76512	Dose 1	14-Mar-21	Covaxin	12-Jun-21	27-Jul-21	USHA SINGH	Irene Hospital	Partially vaccinated
						Dose 2	12-Jun-21	Covaxin	NA	NA	Tarun	Irene Hospital	Fully vaccinated

The attributes identified are:

1. beneficiary name
2. age
3. gender

4. ID verified
5. unique health ID
6. beneficiary reference ID
7. dose number
8. date of each dose
9. name of vaccine
10. Next due date Duration
11. vaccinated by
12. vaccinated at
13. vaccination status

It was observed that dose one and those two are grouped and hence we can say that the first normal form is not satisfied.

First Normal Form:

According to the first normal form, there should be no nested tables for all groups of elements. to make the table satisfy the first normal form the group was removed by giving the sets the values for their missing attributes. after the first normalization, the following table was obtained:

Beneficiary Name	Age	Gender	ID Verified	Unique Health ID	Beneficiary reference ID	Dose num	Date	Vaccine Name	Next Due Date (start)	Next Due Date (end)	Vaccinated by	vaccinated at	Vaccination Status
Athiya Sharma	56	Female	Aadhaar #6547	7564	45372	Dose 1	20-Mar-21	COVISHIELD	18-Jun-21	03-Jul-21	SISTER JIJA	Triton Hospital	Partially vaccinated
Athiya Sharma	56	Female	Aadhaar #6547	7564	45372	Dose 2	21-Jun-21	COVISHIELD	NA	NA	RAVNEET KAUR	GBSS CR PARK	Fully vaccinated
Rahul Gupta	32	Male	Licence #DL 76847	6453	76512	Dose 1	14-Mar-21	Covaxin	12-Jun-21	27-Jul-21	USHA SINGH	Irene Hospital	Partially vaccinated
Rahul Gupta	32	Male	Licence #DL 76847	6453	76512	Dose 2	12-Jun-21	Covaxin	NA	NA	Tarun	Irene Hospital	Fully vaccinated

Before moving to the next normal form, primary keys were identified where ID verified, beneficiary reference ID, and dose num, together identified as the primary keys. Though the beneficiary reference ID could be treated as unique the beneficiary reference ID depends on the ID verified and ID verified could not be used solely because different types of IDs are being used such as Aadhaar, license voter ID other permissible government IDs. hence ID verified and beneficiary reference ID had to be used together and dose number along with them becomes a primary key because of the date and place of vaccination, The person who vaccinated the beneficiary all depends on the dose number, ID verified, and beneficiary reference ID combined

The following schema shows the current entities and the primary keys thus identified.

Covid Vaccination
Beneficiary Name
Gender
Age
ID Verified
Unique Health ID
Beneficiary reference ID
Dose num
Date
Vaccine Name
Next Due Date (start)
Next Due Date (end)
Vaccinated by
vaccinated at
Vaccination Status

Second Normal Form:

The second normal form says there should be no dependencies on a part of the composite key if any such part exists in the table they need to be separated along with that primary key. in this case, we identified that 'beneficiary name, gender, age, and unique health ID' depend only on ID-verified. Moving further we noticed not according to our assumption as vaccination name needs to be the same for dose 1 as well as dose 2, Hence the vaccination name and vaccination status depend solely on beneficiary ID. Rest attributes which are 'date, next due date start, next due date end, vaccinated by, and vaccinated at' depend on all the 3 primary keys identified. After applying the second normal form, the following 3 tables we could identify

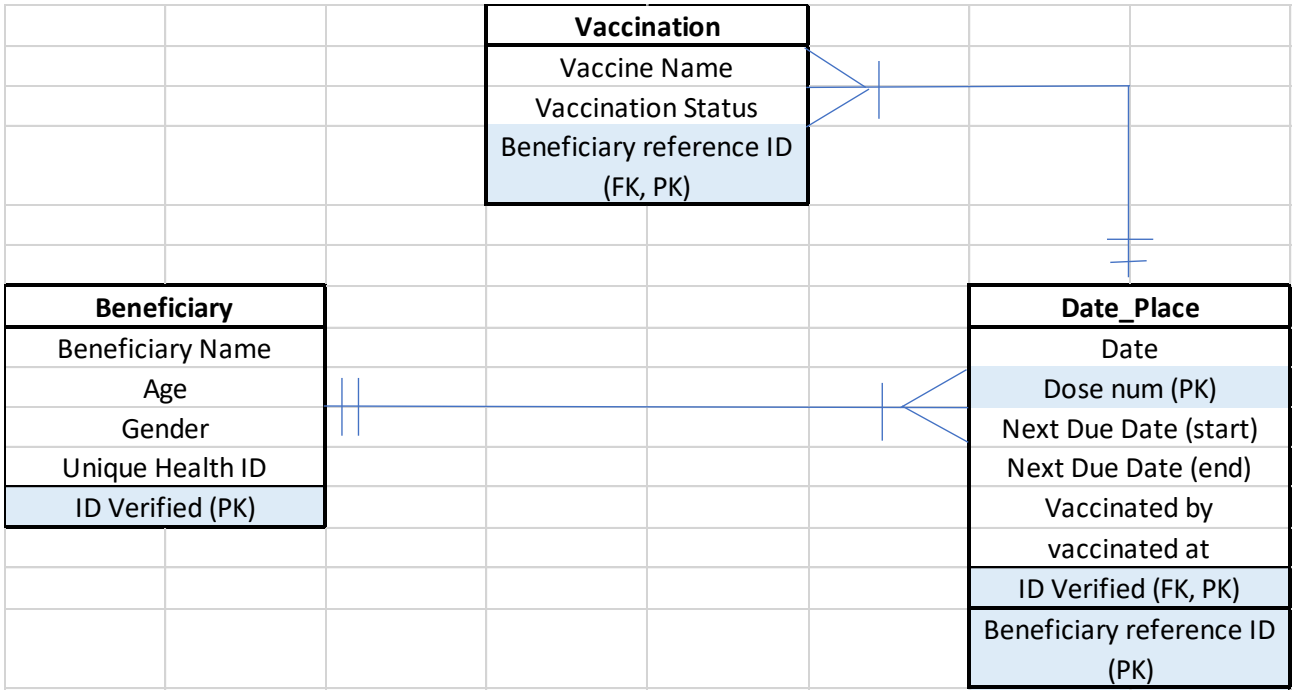
Beneficiary
Beneficiary Name
Age
Gender
Unique Health ID
ID Verified (PK)

Vaccination
Vaccine Name
Vaccination Status
Beneficiary reference ID (PK)

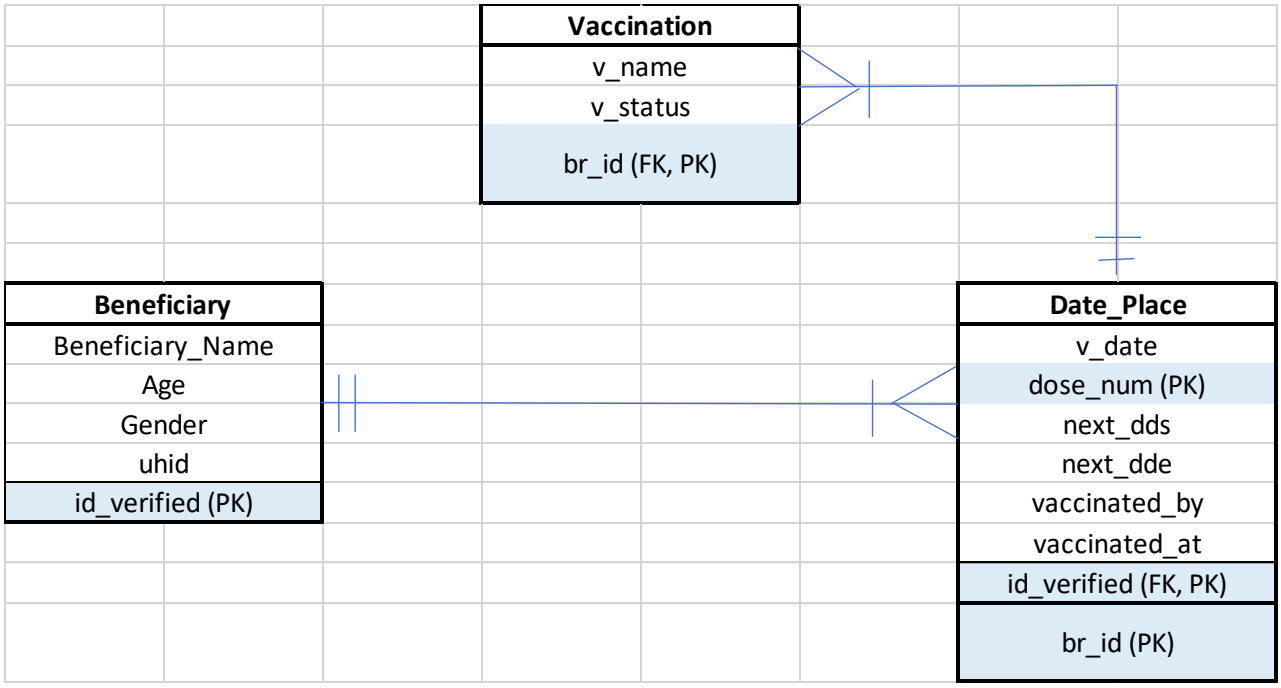
Date_Place
Date
Dose num (PK)
Next Due Date (start)
Next Due Date (end)
Vaccinated by
vaccinated at
ID Verified (PK)
Beneficiary reference ID (PK)

Third Normal Form:

The third normal form says there should be no dependencies on non-key attributes, after going through the above sub tables we were able to come to an opinion that there are no dependencies on non-key attributes and hence further condensation is not required. following are our tables with relationships after normalizing till 3rd normal form.



Attribute names according to the database in MySQL



Assumptions:

Following are the assumptions made:

1. Assuming Beneficiary reference id has vaccination details associated
2. Assuming only one nurse of that name works at a vaccination center, and they too have beneficiary reference id in their foreign key.
3. Assuming Unique Health ID contains details of other comorbidities but is not required for the vaccination certificate

4. Assuming Beneficiary Reference ID is auto generated
5. Assume beneficiary know their Unique Health ID
6. The next due date start, and next due date end cannot be null for dose 1
7. Consequent vaccine dose will be the same
8. There are three genders, and hence data type Enum was used. Genders are Female, Male, Transgender.
9. Assuming only one of the following four vaccines can be administered 'Covaxin', 'Covishield', 'Sputnik V', 'Moderna', hence data type chosen is Enum for v_name.
10. Assuming vaccine is being given only at one of following six vaccination booths 'Triton Hospital', 'Irene Hospital', 'GBSS', 'Defence Colony care', 'Medanta'. Here also Enum was used as data type.
11. Only 2 doses of vaccination are being administered.

The DDL commands for creating databases and tables:

```
create database if not exists vaccineCert;
use vaccineCert;
```

Create Beneficiary Table

```
create table if not exists beneficiary(Beneficiary_Name varchar(50),
   age tinyint,
   gender Enum('M','F','T'),
   uhid char(16) unique,
   id_verified char(30) primary key);
```

Create date_place Table

```
create table if not exists date_place(v_date DATE not null,
 dose_num Enum('Dose 1', 'Dose 2') not null,
 next_dds DATE,
 next_dde DATE,
 vaccinated_by char(30),
 vaccinated_at Enum('Triton Hospital', 'Irene Hospital', 'GBSS', 'Defence Colony care', 'Medanta'),
 id_verified char(30) not null,
 br_id char(13) not null unique,
 foreign key(id_verified) references beneficiary(id_verified),
 primary key(id_verified, br_id, dose_num),
 constraint chk_dose1 Check(dose_num = 'Dose 1' AND next_dds is not null AND next_dde is not null));
```

Create date_place Table

```
create table if not exists vaccination(v_name Enum('Covaxin', 'Covishield', 'Sputnik V',
'Moderna'),
v_Status Enum('Partial', 'Fully Vaccinated'),
br_id char(13) primary key,
foreign key(br_id) references date_place(br_id));
```

Following commands are used for creating roles, defining privileges, and assigning the roles to the users.

Role creation

```
CREATE ROLE 'dba', 'vaccine_admin', 'beneficiary';
```

Grant permissions to roles

```
GRANT ALL ON vaccineCert.* TO 'dba';
GRANT SELECT ON vaccineCert.* TO 'beneficiary';
GRANT INSERT, UPDATE ON vaccineCert.beneficiary TO 'beneficiary';
GRANT SELECT, INSERT, UPDATE ON vaccineCert.vaccination TO 'vaccine_admin';
GRANT SELECT, INSERT, UPDATE ON vaccineCert.date_place TO 'vaccine_admin';
```

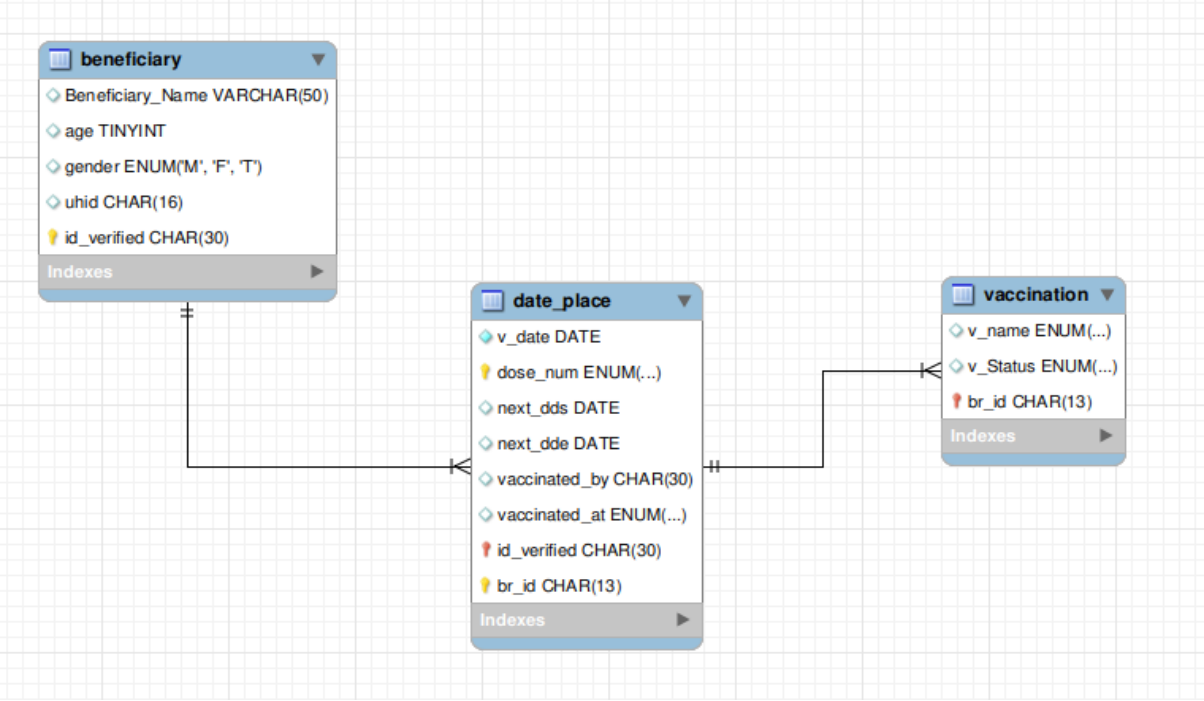
User creation code

```
CREATE USER 'joshi'@'localhost' IDENTIFIED BY 'joshi' ;
CREATE USER 'ravneet'@'localhost' IDENTIFIED BY 'ravneet' ;
CREATE USER 'athiya'@'localhost' IDENTIFIED BY 'athiya' ;
```

Grant Roles to users

```
GRANT 'dba' TO 'joshi'@'localhost';
GRANT 'beneficiary' TO 'athiya'@'localhost';
GRANT  'vaccine_admin' TO 'ravneet'@'localhost';
```

After executing the MySql codes the following ER diagram was obtained:



Conclusion:

The vaccineCert database stores the information of beneficiaries who received COVID 19 vaccination and keeps track of the vaccination status of the citizens.

Reference form

Ministry of Health & Family Welfare
Government of India

Provisional Certificate for COVID-19 Vaccination - 1st Dose

Beneficiary Details

Beneficiary Name	TRIPTI BANERJEE
Age	76
Gender	Female
ID Verified	Aadhaar # XXXXXXXX9759
Unique Health ID (UHID)	
Beneficiary Reference ID	16[redacted]7

Vaccination Details

Vaccine Name	COVISHIELD
Date of Dose	20 Mar 2021 (Batch no. 4120Z010)
Next due date	Between 01 May 2021 and 15 May 2021
Vaccinated by	SISTER JIJA
Vaccination at	Triton Hospital, South East Delhi

Ministry of Health & Family Welfare
Government of India

Certificate for COVID-19 Vaccination

Fully Vaccinated : **2nd Dose**

Beneficiary Details

Beneficiary Name / लाभार्थी का नाम	**TRIPTI BANRJEE**
Age / उम्र	**76**
Gender / लिंग	**Female**
ID Verified / पहचान पत्र सत्यापित	**Aadhaar # XXXXXXXX9759**
Unique Health ID (UHID)	**44-6565-1780-1764**
Beneficiary Reference ID	**16295572661[illegible]07**

Vaccination Details

Vaccine Name / वैक्सीन का नाम	**COVISHIELD**
Date of 1st Dose / पहली खुराक की तारीख	**20 Mar 2021 (Batch no. 4120Z010)**
Date of 2nd Dose / दूसरी खुराक की तारीख	**12 Jun 2021 (Batch no. 4121Z083)**
Vaccinated by / टीका लगाने वाले का नाम	**RAVNEET KAUR**
Vaccination at / टीकाकरण का स्थान	**GBSSS CR PARK 1925055, South East Delhi, Delhi**

"दवाई भी और कड़ाई भी।
Together, India will defeat COVID-19"