# MBUA512 Project

# Covid-19 Vaccination Tracking

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**Abstract**

At the beginning of 2021, there has been a glimmer of hope with the fast track, development approval of multiple vaccines that can combat Covid 19 and its spread, and provide immunization and protection for people worldwide.

Aotearoa, New Zealand, has done an admirable job by world standards in keeping its team of 5 million safes. Thus, a smooth vaccination process is necessary to safeguard New Zealand citizens further and allow the reopening of the travel borders to the world, starting with upcoming travel bubbles with our neighbors in Australia and the Pacific, bringing life back to a degree of normality to society.

Like many nations, Aotearoa, New Zealand faces the challenges of developing a smooth vaccine rollout and vaccination tracking system, which needs to be robust, secure, and adaptable to the challenges within the current Covid 19

This database aims to model, build, and document a Covid 19 vaccination tracking system for New Zealand. Our database will monitor the recording of vaccination status for both local patients and overseas returnees and the vaccine type, which may change in favorability and availabilities depending on global inventory needs and data efficacy developments.

This document contains an E-R model of the Vaccination database with entities, attributes and relationships of the database clearly defined.

# ER Diagram
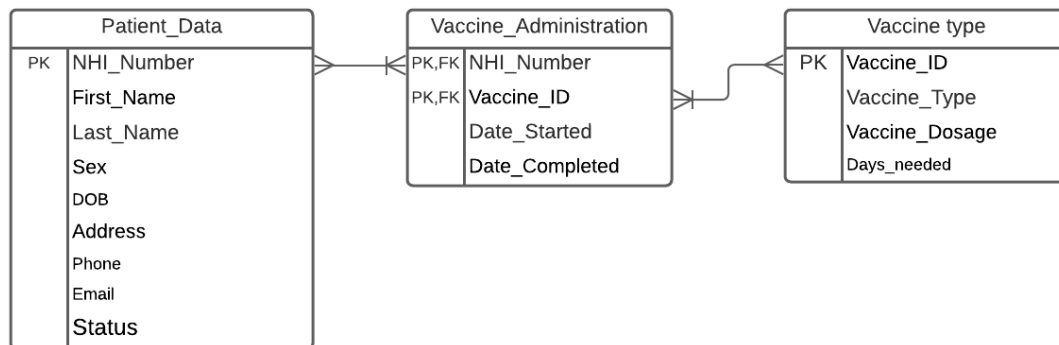


There are three entities drawn for this case, namely:

**Patient_Data: Patient data including both local and overseas returnee New Zealanders.**

Attributes

NHI_Number – National Health ID Number: unique identifier for the table, primary key.
First_Name – First name of a patient.
Last_Name – Last name of a patient.
Sex – Gender identifier.
DOB – Date of birth of a patient.
Address – Current living address of a patient.
Phone – Current phone Number of a patient.
Email – Current phone Number of a patient.
Status – Status to identify if the patient is Local or an Overseas returnee and a VACPASS holder.

**Vaccine_Administration: This is the record for tracking patient vaccination status for both local and overseas patients.**

Attributes
NHI_Number – National Health ID Number: unique identifier for the table, primary key. Foreign Key from Patient table.
Vaccine_ID – Type of vaccine, foreign key from vaccine type table.
Date_Started – Start date of vaccine delivery.
Date_Completed – Completion date of vaccine delivery.  This will vary depending on dosage requirements.

**Vaccine_Type: Is the record of all vaccines to be used for the vaccine administration process.**

Attributes
Vaccine_ID – Unique identifier for the table, primary key.
Vaccine_Type – Name of the vaccine.
Vaccine_Dosage – Numerical identifier of total dosages needed to complete the vaccination.
Days_Needed – Numerical identifier of days needed between vaccine dosages.

**Assumptions**
- Overseas returnees will have to show their VACPASS to their DHB on return. It is recorded in the Vaccine Administration table, and they will not need a local vaccination.
- If an Overseas returnee does not have a VACPASS, they will need to get a vaccine locally.
- Patients can have multiple vaccine types where needed.
- Vaccine types may increase or decrease depending on market developments.
- Current Covid 19 Vaccine's on the market do not exceed more than 2 doses, and no more than 28 days apart.

**Cardinalities & Degree:** Both the Patient & Vaccine Administration Record relationships are of degree 2 (two types of entities involved, Patient and Vaccine Administrator), and N-N: a Patient can receive one or many vaccines by many Vaccine Administrators, and many Vaccine Administrator can administer one or many vaccines to multiple Patients.

There is also a Vaccine type & Vaccine Administer relationship, a degree of 2, and N-N: many Vaccine Administers can use many Vaccines and many Vaccines can be used by many Vaccine Administers.

**Normalizations:** All the tables are clearly in 3NF

- They meet the requirements for first NF (no multivalued attributes);
- All functional dependencies are full: they cannot be partial since the PKs all have single attributes, and there are no transitive dependencies.
- Specifically, for the Patient table all attributes depend solely on the NHI, for the patient details, and the vaccination administration record. For the other table, everything depends solely and directly on the PK of the Vaccine ID.

# E-R to DATABASE MODELLING

The relationship has already been established in the E-R modelling, the next step is to create the tables and load the data in the database.

Below is the syntax used to create the tables in SQLITE.

```
CREATE TABLE "Patient_Data" (
        "NHI_Number"          INTEGER,
        "First_Name"  INTEGER,
        "Last_Name"  INTEGER,
        "Sex"   TEXT,
        "DOB"  INTEGER,
        "Address       "        TEXT,
        "Phone"        NUMERIC,
        "Email"        INTEGER,
        "Status"       TEXT,
        PRIMARY KEY("NHI_Number")
);

    CREATE TABLE "Vaccine_Administration" (
        "NHI_Number"          INTEGER,
        "Vaccine_ID"  INTEGER,
        "Date_Started"        INTEGER,
        "Date_Completed"     INTEGER,
        PRIMARY KEY("NHI_Number","Vaccine_ID"),
        FOREIGN KEY("Vaccine_ID") REFERENCES "Vaccine_Type"("Vaccine_ID"),
        FOREIGN KEY("NHI_Number") REFERENCES "Patient_Data"("NHI_Number")
    );

    CREATE TABLE "Vaccine_Type" (
        "Vaccine_ID"   INTEGER,
        "Vaccine_Type        "        INTEGER,
        "Vaccine_Dossage"    INTEGER,
        "Days_needed"        INTEGER,
        PRIMARY KEY("Vaccine_ID")
    );
```

Data for each table are stored on csv format and imported into the database. When loading the csv file, the sequence will be as follows: (1) Patient_Data, (2) Vaccine_Administration, (3) Vaccine_Type

**SQL Queries**

1.  **Who has received the Janssen vaccine (which only requires a single dose)?**

SELECT *
FROM Patient_Data NATURAL JOIN Vaccine_Type NATURAL JOIN  Vaccine_Administration
WHERE Vaccine_ID = '2' AND Date_Completed IS NOT NULL

2.  **Who has not received any vaccination doses, and needs to be vaccinated (i.e. exclude those who have provided proof of overseas vaccination)**

SELECT *
FROM Patient_Data NATURAL JOIN Vaccine_Type NATURAL JOIN  Vaccine_Administration
WHERE date_started IS NULL AND Vaccine_ID IS NOT '3'

3.  **Who has received both doses of the Comirnaty vaccine?**

SELECT *
FROM Patient_Data NATURAL JOIN Vaccine_Type NATURAL JOIN  Vaccine_Administration
WHERE Vaccine_ID = 1 AND Date_Started IS NOT NULL AND Date_Completed IS NOT NULL

4.  **Create a list of all people who have received at least one dose of the Comirnaty vaccine, and show for each person how many doses they have received. Order by the number of doses descending, i.e. the first few rows in the table will be the people who have had the highest number of doses of the vaccine.**

SELECT*,
CASE
WHEN Date_Completed IS NOT Null THEN '2'
WHEN Date_Started is not NULL THEN '1'
ELSE  '0'
END AS 'total_dosages'
FROM Patient_Data NATURAL join Vaccine_Administration
WHERE Vaccine_ID = '1' AND total_dosages >= '1'
ORDER BY total_dosages DESC;

5.  **Who has received doses of more than one type of vaccine?**

SELECT First_Name,Last_Name, NHI_Number, COUNT(*) AS 'Multiple dosage'
FROM Patient_Data NATURAL JOIN Vaccine_Administration
GROUP BY NHI_Number
HAVING COUNT(*) > 1

6.  **Who has received only one dose of the Comirnaty vaccine, and is now due to receive their second dose (i.e. the first dose was at least 21 days ago)?**

SELECT*, date(date_started, '21 days') as 'Due_date'
FROM Patient_Data NATURAL JOIN Vaccine_Type NATURAL JOIN Vaccine_Administration
WHERE Vaccine_ID = '1' AND Date_Completed IS NULL AND Date_Started IS NOT NULL AND
Due_date <=date('now')

```
SELECT *
FROM Patient_Data NATURAL JOIN Vaccine_Type NATURAL JOIN Vaccine_Administration
WHERE Date_Completed IS NOT NULL
```