Database Management System (IT-214)

2021

DA-IICT

Section 2 - Team 6

Chickenpox Vaccination Drive Management System

Name of group members:

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Section1:

Final version of SRS

Introduction

Purpose:

To create a systematic way to provide chickenpox vaccines to all eligible people and keep track of vaccinated and unvaccinated people and other related information using a database which provides a management system for vaccination drives.

Intended audience and Reading suggestions:

Different types of readers: Developers, Project Managers, Testers, Marketing staff, users-1 (administrators and staff), users-2 (people to be vaccinated) and documentation writers .

Sr No.	Reader Type	Reading suggestions
1	Developers	1.The team who developes the software 2. [A] - [J]
2	Project Managers	1.The team who takes care of functional aspects 2. [A] - [J]
3	Testers	1.The team which checks the software for proper functioning 2. [D]
4	Marketing staff	1.The team which promotes the software 2. [E] , [G] , [I] , [J]
5	users-1	1.The people who will run vaccination centers. 2. [A] - [J]
6	users-2	1.The common people who take the vaccine. 2. [A] , [B] (only Flow and Features)
7	Documentation writers	1.The team who makes the structured document 2.[A]-[J]

The rest of the SRS describes a detailed description of the vaccination process, an overview of different fact-finding techniques, product requirements, product functions, product requirements, user classes and characteristics, privilege classes and business constraints. The structured and organised form of the document helps in efficiently listing the requirements and thus in developing the software further.

Product scope:

The software serves as a one stop destination to keep an account of all domains related to the Chickenpox vaccine. People from various age groups can book slots online or offline at their desired time,convenience and based on availability of different centers. The database keeps track of details of vaccination centers, vaccine stocks, which employees are available for doorstep visits, personal details of people, etc.

Description:

About the disease:

- Varicella (chickenpox) is an acute, highly contagious viral disease with worldwide distribution.
- The highest prevalence occurs in the 4-10 year age group but tends to be more severe in adults.
- Chickenpox is usually treated as a harmless childhood disease, and rarely rated as an important public health problem, but this can be severe and even fatal in otherwise healthy children.
- Chickenpox can cause pneumonia and is an important risk factor for developing severe invasive streptococcal disease.
- Complications of chickenpox include bacterial infections, decreased platelets, arthritis, hepatitis, pneumonia.
- Chickenpox is the leading cause of vaccine-preventable death in children.
- Universal vaccination can cause a dramatic reduction in the incidence of varicella, associated complications, hospitalizations and fatality rates.

Precautions:

Chickenpox vaccine is not suitable for everyone.

The type of people who **can not** register for the vaccine:

- People who are currently affected by chickenpox.
- If people had a life-threatening allergic reaction in response to the previous dose.
- Who are moderately or severely ill at the time the slot is scheduled.
- Pregnant women should not get chickenpox vaccines.
- People who have a severe disease that affects immunity system

The chickenpox vaccine is recommended for **all children under age 13 who have not had chickenpox**. It is also recommended for all adolescents and adults who have not been vaccinated and have not had chickenpox. There is no need to take the vaccine if a person has had chickenpox.

The type of people who **should** necessarily register for the vaccine:

- Healthcare professionals
- Childcare workers
- Residents and staff of nursing homes
- International travellers
- Military personnel
- Non-pregnant women of child-bearing age

Registration:

- Citizens of any age can register for the vaccination. Registration can be done online, offline or door-to-door.
- At the registration time system will take data such as Registration ID, Vaccine ID, Vaccine Name, Registration Mode, Center ID, Dose and Registration Time and Date.
- The people who are currently affected by chickenpox, had a life-threatening allergic reaction in response to the previous dose, women who are pregnant or are severely ill at the time when slot is scheduled should not register for the vaccination.

- Registered user include details about their previous(first) dose details and also guardian details (if any)
- For the online registration, the user has to register on an online portal.
- Here each registered user will have some data such as User Id, User Name,User Age, User Gender, User Address, User Phone Number and User Guardian details.
- In the registration process there are details also: first dose or first dose has already been taken already and second dose.
- There are registered slot details too which contain slot time.
- Government vaccination center takes no charges for vaccinating people while prices for private centers are restricted by the government to prevent black marketing.
- Show the vaccine price while registering from private organizations.
- Registration is based on unique identity. Infants do not have aadhar card or voter card so birth certificates will be used for unique user identity.

Scheduling Appointment:

- One can book a slot online or can reach the designated vaccination center for offline scheduling. If the slot is free, they receive the vaccination on the spot. Or else they will get a dose scheduled on some other near and convenient day.
- Each slot will have its corresponding slot ID. The slot will have details such as time, date, day. The users will be able to see such details while registering. The online registration capacity of each slot will also be shown. No more slots than this capacity can be booked.
- To provide the registered slot rescheduling facility before 12 hours in case a user is not available due to an emergency. We are providing them a facility so that they can change the slots according to their convenience. Also users should not reschedule the slot before less than 12 hours as that will not give enough time to other users to book that slot.
- While booking slots, the details of a consultant doctor will also be given. The patient can contact that doctor in case of complications due to vaccination.
- Sometimes users unnecessarily book the slots or they don't reach to take the vaccine in a given slot, because of that other users can not book that slot. If this behaviour is repeated more than three times by a specific user then his/her online registration process will be cancelled and he/she will not be able to register online (for that dose) again. In this case, the person will have to do the on-site (offline) registration in order to avail the vaccine.
- Another way to take the vaccine is through door-to-door appointment. The government health care workers come to your home and give you the vaccine if you are underprivileged. In case of private institutions, door-to-door service is chargeable.
- While scheduling an appointment for vaccination, the system will show vaccination centre names along with the name of the vaccine that will be administered.
- Vaccination centers based on locality - pincode or area name etc. will be shown. If these details are provided, it becomes convenient for the user to book the nearest center.
- The registration slip can be downloaded after the appointment has been scheduled.

- Once an appointment is scheduled, you will receive the details of the vaccination centre, date and time slot chosen for appointment in an SMS sent to your registered mobile number. You can also download the registration slip and print it or keep it on your smartphone.
- People registering for 2nd dose should have already taken 1st dose and 1st dose should have been taken before at least 1 month. This is because it is necessary to have a gap of 1-3 months before taking the 2nd vaccine for online registrations.

Vaccination process:

- Each vaccination center will have its corresponding center ID, center name, center address. The vaccination center type,i.e, private or government or both, will also be assigned.
- Each vaccination center will also have its maximum staff capacity. This will show the maximum staff that the vaccination center can contain.
- For each vaccination center, there will also be an administrator which oversees all the aspects.

- The Vaccination Centres are directed to ensure that if a citizen is being vaccinated with 2nd dose, they should confirm that the first dose vaccination was done with the same vaccine as is being offered at the time of second dose and that the first dose was administered more than 28 days ago for offline registrations.
- After successful vaccination, a vaccination certificate will be provided to you that states you have successfully taken the vaccine. Unique e-certificate id will be provided using which the user can access e-certificate from the corresponding e-portal.
- The Vaccination Centre is responsible for generating your certificate and for providing a printed copy post vaccination on the day of vaccination itself. Please do insist on receiving the certificate at the Centre.

Vaccine details:

Varivax

- Contains only chickenpox vaccine
- Is licensed for use in children age 12 months and older, adolescents, and adults
- Can be given to children for their routine two doses of chickenpox vaccine at age 12 through 15 months and age 4 through 6 years

ProQuad

- Contains a combination of measles, mumps, rubella, and varicella (chickenpox) vaccines, which is also called MMRV
- Is only licensed for use in children age 12 months through 12 years

Vaccination Management functionalities:

- Administrators of each center will manage all the functionalities related to vaccine management at different centers. A common employee table will help to keep track of administrator details, doctor details and staff details of different vaccination centers. It also has details like admin landline number,doctor email address and staff type.
- Dynamic online slots. If a vaccination slot is suitable for many people then there will be a lot of online and offline registration for that particular slot. In this case, if we have a rough idea about the number of people coming offline for a particular slot or we can do an offline slot approximation analysis, then we can set a limit to online registrations providing dynamic online slots. So that we can easily provide vaccines to each registered user.
- Record the number of doses of vaccines available, in real-time and also record the 1st dose and 2nd dose details like e-certificate id, vaccine id. At each center, details of remaining proquad vaccine and varivax vaccine will be stored for every corresponding date.
- Give details of consultant doctors like doctor id, doctor name, doctor number so that users can consult doctors at vaccine centers.
- Allocate a unique vaccine id. It may happen that at the end of a working day, all vaccines may not have been used (some users may have failed to show up) or some vaccines may have gone wasted. Vaccine id helps to keep track of those.
- At the end of each day we can check the staff utilisation using the number of vaccines provided or the number of registrations done by each staff member. This will help us to transfer the staff member with less utilisation to the center with full utilisation (given transferring this staff member will not make another center to cross staff capacity of that center).
- Also, if a new staff member is added we can allot that staff member to the center with full utilisation. In this way, staff utilisation will help us to remove, transfer and add staff members to the different centers.
- To give users the details of allocated staff members like staff id, staff name, staff type from whom they are taking their vaccine for user reference.
- It also records allocated staff details like staff id, center id, date at which the staff allocated to that center, and attended users.
- Update the user's registered data (if required). Sometimes it may happen that the user wants to update some details like name, age, gender etc. We need to allow users to update wrong/invalid data.

- It also records allocated staff details like staff id, center id, date at which the staff allocated to that center, and attended users.
- Each center has some limited space or area which can be used for vaccination drives.For example, if each of the staff members can provide vaccines to 10 users, then 5 staff members will be able to provide vaccines to 50 people. It is necessary to know, in one time slot, whether the center area will be able to cover 50 people or not. If not then the place will be much crowded. To solve this problem, we can set a limit to the number of staff members in the center, this will limit the number of registrations hence solving the problem.
- It may happen that at the end of a working day, all vaccines may not have been used (some users may have failed to show up) or some vaccines may have gone wasted. At the end of each day, remaining vaccines will be returned and a report of wasted vaccines will be given to the authorities. In this way, the center's stock details are kept account of.

Fact Finding Phase

1) Background Reading:

Working and flow:

We studied the existing vaccination system. The inference of various stages in the vaccination system is as follows:

Registration:

- For the online registration, log in into the online portal and click on the "Register/Sign In yourself" tab to register for chickenpox vaccination.
- Citizens of any age can register for the vaccination.
- The people who are currently affected by chickenpox, had a life-threatening allergic reaction in response to the previous dose, women who are pregnant or are severely ill at the time when slot is scheduled should not register for the vaccination.
- The registration process will include details about their name, age, previous dose details, guardian details (if any)
- Registration can be done online or offline.
- Government vaccination center takes no charges for vaccinating people.
- Registration on the portal can be done using any of the following ID proofs: a. Aadhaar card b. Driving License c. PAN card d. Passport e. Pension Passbook f. NPR Smart Card g. Voter ID h.Birth Certificate

Scheduling Appointment for 1st dose and 2nd dose:

- One can book a slot online or can reach the designated vaccination center. If the slot is free, they receive the vaccination on the spot. Or else they will get a dose scheduled on some other near and convenient day.
- Another way to take the vaccine is through door-to-door appointment. The government health care workers come to your home and give you the vaccine if you are underprivileged. In case of private institutions, door-to-door service is chargeable.
- While scheduling an appointment for vaccination, the system will show vaccination centre names along with the name of the vaccine that will be administered.
- The appointment slip can be downloaded after the appointment has been scheduled.

- You cannot cancel an appointment already scheduled. You can also reschedule the appointment and choose another date or time slot of your convenience.
- Once an appointment is scheduled, you will receive the details of the vaccination centre, date and time slot chosen for appointment in an SMS sent to your registered mobile number. You can also download the appointment slip and print it or keep it on your smartphone.
- It is recommended that both doses of vaccine should be taken 1-3 months apart for realising the full benefit of vaccination. Both doses must be of the same vaccine type.

Vaccination:

- Vaccination is free at Government hospitals and charged up to pre decided amount per dose in Private hospitals. Citizens can get this information while booking an appointment.
- The Vaccination Centres are directed to ensure that if a citizen is being vaccinated with 2nd dose, they should confirm that the first dose vaccination was done with the same vaccine as is being offered at the time of second dose and that the first dose was administered more than 28 days ago.
- After successful vaccination, a vaccination certificate will be provided to you that states you have successfully taken the vaccine.
- The Vaccination Centre is responsible for generating your certificate and for providing a printed copy post vaccination on the day of vaccination itself. Please do insist on receiving the certificate at the Centre.
- You can also download the certificate from the online portal.

Features:

Any vaccine management software will allow us to manage vaccination processes and workflows with features such as inventory management for managing and maintaining the supply chain, and patient management features for storing patient-related information and tracking vaccination doses.

Below are some common features that any vaccine management software will have:

- **Appointment Management**: Register and schedule/reschedule appointments for vaccination slots and sites. Selection of vaccination centers of convenience. Schedule vaccination Date as per slot availability at a center. Once the appointment is fixed it can be rescheduled at any later stage but before the vaccination appointment day.
- **Medical Records:** Create patient medical records that include vaccination records for first and second doses.
- **Vaccine Information/Guidelines:** Send patients information about vaccines and what they should expect at the vaccination site. Deliver educational content to patients and address their vaccine hesitancy with knowledge bases, virtual assistants, and more.
- **Reminders:** Text/Email for initial and second doses, as well as specific instructions to follow once they get vaccinated.
- **Follow-ups/alerts:** Send instructions to patients via text/email about who to contact in case of emergency. Also record any side effects they experience using an e-form.
- **Waitlist Management:** Manage your patient queues and waitlists based on custom criteria, and set priorities, such as for healthcare workers and other frontline essential workers.

Below are some features of CoWIN app, which is the official COVID-19 vaccination registration app in India for reference:

- CoWIN will give permission to create a Unique Health ID for every user.
- After administration of both doses of a COVID-19 vaccine, a QR code certificate will be generated which can be stored on the government's DigiLocker app.

- The app will provide an automated allocation of vaccination sessions. One of the authentication methods would be the use of the Aadhaar number to prevent malpractice in the vaccination drive, reported NDTV.
- In case of any adverse effect following immunisation, there is a provision for real-time reporting on the digital platform.
- The app includes features like SMS in 12 languages, 24X7 helpline, and others.

Flaws:

- Some of the problems that were reported on the vaccine management app from several cities across the country are that registered beneficiaries failed to receive prior intimation on attending centers to receive the vaccination and other major glitches that even slowed down the process of delivering vaccines.
- In the wake of the wide-scale COVID-19 vaccination that is in active progression across India, a new development in the form of fake CoWIN vaccination apps are threatening the process of genuine vaccination and slot booking, as was reported by CERT-In.
- Many citizens started facing errors at the OTP stage itself, getting " Unexpected Error" as well as "Server is facing issues. Please try later," messages.
- While some are facing issues with the OTP, others are not able to find any slots for weeks after successfully registering.
- Jio network glitch affected the vaccination work as many of the centers depended on mobile internet connection or got the connectivity through a Wi-Fi dongle to get the connectivity with the vaccine management software, especially many centers in the rural areas and some in urban areas.The trouble due to Jio's network going down many centers faced trouble in the registration of beneficiaries and also affected the target of vaccination.

References:

- https://vaccineindia.org/article/chickenpox
- https://www.mygov.in/covid-19
- https://pubmed.ncbi.nlm.nih.gov/21791972/
- https://palpalnewshub.com/india-news/special-features-of-cowin-app-created-for-vaccination-know-the-full-detail/
- https://cyberdaily.securelayer7.net/multiple-fake-cowin-vaccination-apps-duping-users-cert-in-advisory/
- https://www.msn.com/en-in/news/other/glitches-in-cowin-20-hold-up-vaccination-centre-must-upgrade-app-capacity-to-meet-demand-say-experts/ar-BB1e78xi

Requirements from Background Reading:

- To get all the details of the user while registering
- To understand about the preferences of users from online/offline/door-to-door mode
- To see that person is eligible to take the vaccine. Priority classes should get higher preference
- To record the number of doses of vaccines available, in real-time
- To assure that people registering for 2nd dose have already taken 1st dose
- To assure efficient working of app with slot details
- To see that vaccines do not get wasted
- To manage patient queues and waitlists based on custom criteria, and set priorities
- To schedule vaccination date as per slot availability at a center
- To provide selection of vaccination centers of convenience
- To provide adequate staff at each vaccination center

- To provide the slot rescheduling facility
- To show the price of vaccine while registering privately

2) Interviews:

1. Management Requirements: (Role Play) Interview Plan

System: Vaccination drive management

Interviewee: Kavya Parikh **(Role Play)**

Designation: Head of Management at city vaccination center

Interviewer: Nidhi Manek

Designation: Developer of software required for vaccination drive management system

Date: 6/10/2021 **Time:** 11:00 AM

Duration: 45 minutes

Purpose of Interview:

To identify the issues and requirements regarding the management of the drive.

Agenda:

Identify and discuss the problems related to management of users, staff and stock of vaccines.

Management Requirements: (Role Play) Interview Summary

System: Vaccination drive management

Interviewee: Kavya Parikh (**Role Play)**

Designation: Head of Management at city vaccination center

Interviewer: Nidhi Manek

Designation: Developer of software required for vaccination drive management system

Date: 6/10/2021 **Time:** 11:00 AM **Duration:** 45 minutes

Purpose of Interview:

To identify the issues and requirements regarding the management of the drive.

1. Unique user id: If a user wants to register for the vaccine then he/she will be able to register using only the birth-certificate. So that we can prevent the system from multiple registrations for the same user.
2. Online registration prohibition: If a user fails to reach the slot at a given time, this failure is allowed for maximum 3 times for that slot. It is to prevent users from unnecessarily booking slots. After it, the person will have to do the on-site (offline) registration in order to avail the vaccine.
3. E-certificate: The users will be given the unique e-certificate id from which they will be able to access the e-certificate from e-portal.

4. Remaining and wasted vaccine management: At the end of each day, remaining vaccines will be returned and a report of wasted vaccines will be given to the authorities.
5. Dynamic online slots: If a vaccination slot is suitable for many people then there will be a lot of online and offline registration for that particular slot. In this case, if we have a rough idea about the number of people coming offline for a particular slot, then we can set a limit to online registrations. So that we can easily provide vaccines to each registered user.
6. Staff capacity of centers: Each center has some limited space or area which can be used for vaccination drives. To cover the registered people in the given area in a given slot (to avoid crowd), there should be a limit to registrations per slot and hence there should be a limit to the number of staff members in the center.
7. Staff utilisation: At the end of each day we can check the staff utilisation using the number of vaccines provided or the number of registrations done by each staff member. This will help us to transfer the staff member with less utilisation to the center with full utilisation (given transferring this staff member will not make another center to cross staff capacity of that center).

2. User Requirements: (Role Play) Interview Plan

System: Vaccination Drive Management

Project Reference: SF/SJ/2021/13

Interviewee: Amisha Sharma(**Role Play**)

Designation: User Requirements Head

Interviewer: Vidhi Badrakiya

Designation: Administrator at Vaccine management drive

Date: 7/10/2021 **Time:** 10:30 AM

Duration: 30 minutes **Place:** Vaccine center

Purpose of Interview:

Meeting to identify problems and requirements regarding Vaccination drive for each mode from the user's perspective.

Agenda:

Problems with User’s experience and their concern about vaccination center

Mobile application concerns

User Requirements: (Role Play) Interview Summary:

System: Vaccination Drive Management

Project Reference: SF/SJ/2009/13

Interviewee: Amisha Sharma(**Role Play**)

Designation: User Requirements Head

Interviewer: Vidhi Badrakiya

Designation: Developer of Vaccine management drive for software

Date: 7/10/2021 **Time:** 10:30 AM

Duration: 30 minutes **Place:** Vaccine center

Purpose of Interview:

Meeting to identify problems and requirements regarding Vaccination drive for each mode from the user's perspective.

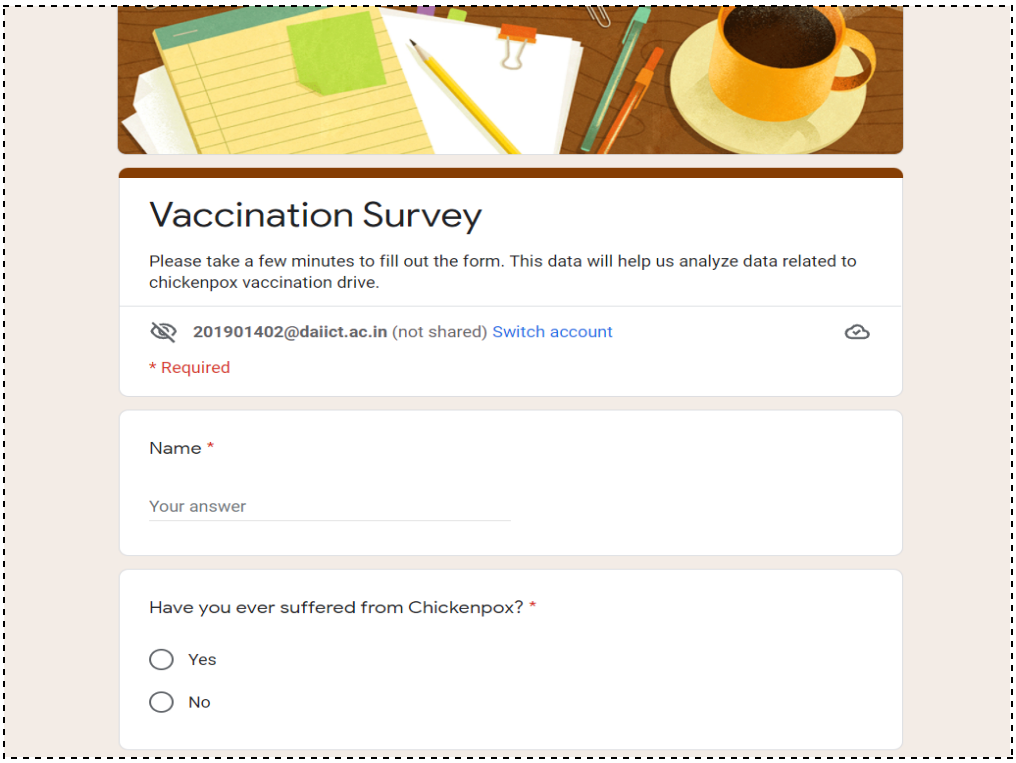
1. Registration process should be based on a unique identity.
2. People come to the vaccination center after registering online(slot wise) then also they have to wait for a long time in the queue.
3. Mobile applications should give vaccination centers according to the user's locality.
4. There should be a choice of preference for users.
5. Users should get vaccine id for verification of vaccine.
6. Users want to get details of the person from whom they are getting the vaccine.
7. If in case pre-booked slot time is missed by the user then users should get a chance to book another slot.
8. In receipt there should not be any spelling mistakes.
9. It should give confirmation that the vaccine has been taken as early as possible.

Requirements from Interview:

- To implement constraint in such manner so that registration is based on unique identity
- To determine staff utilisation at the end of each day which will help to transfer, remove or add staff members from different centers
- To implement method so that user don't have to wait in queue for longer (set slots capacity)
- To give E-certificate id
- To determine the staff capacity of each centers and allocate staff accordingly
- To implement choice for user preference
- To add unique vaccine id
- To give user details of person from them they are taking their vaccine
- To provide dynamic online slots according to staff capacity of center and approximate idea of offline registrations
- Updation of user's registered data (if required)
- To implement registration in such manner so that they can register again (for user which are registering online if pre-booked slots are missed)
- To set a unique user id that identifies user uniquely
- To manage remaining and wasted vaccines
- To provide unique e-certificate id using which user can access e-certificate from the corresponding website
- To prohibit online registration - If the user is not able to reach in a given time slot for more than three times

3) Questionnaire:

https://docs.google.com/forms/d/1pVBsN62DwzQAjsxfaKUtyUMBnl4q5brlPdgRogRkZ6g/viewform?edit_requested=true



Vaccination Survey

Please take a few minutes to fill out the form. This data will help us analyze data related to chickenpox vaccination drive.

201901402@daiict.ac.in (not shared) Switch account

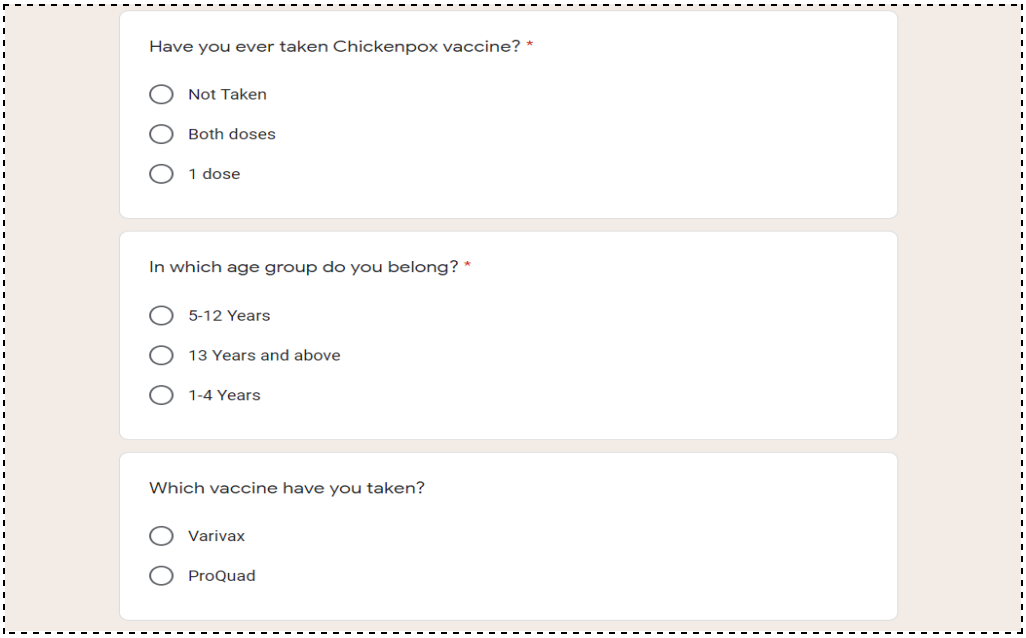
* Required

Name *

Your answer

Have you ever suffered from Chickenpox? *

- Yes
- No



Have you ever taken Chickenpox vaccine? *

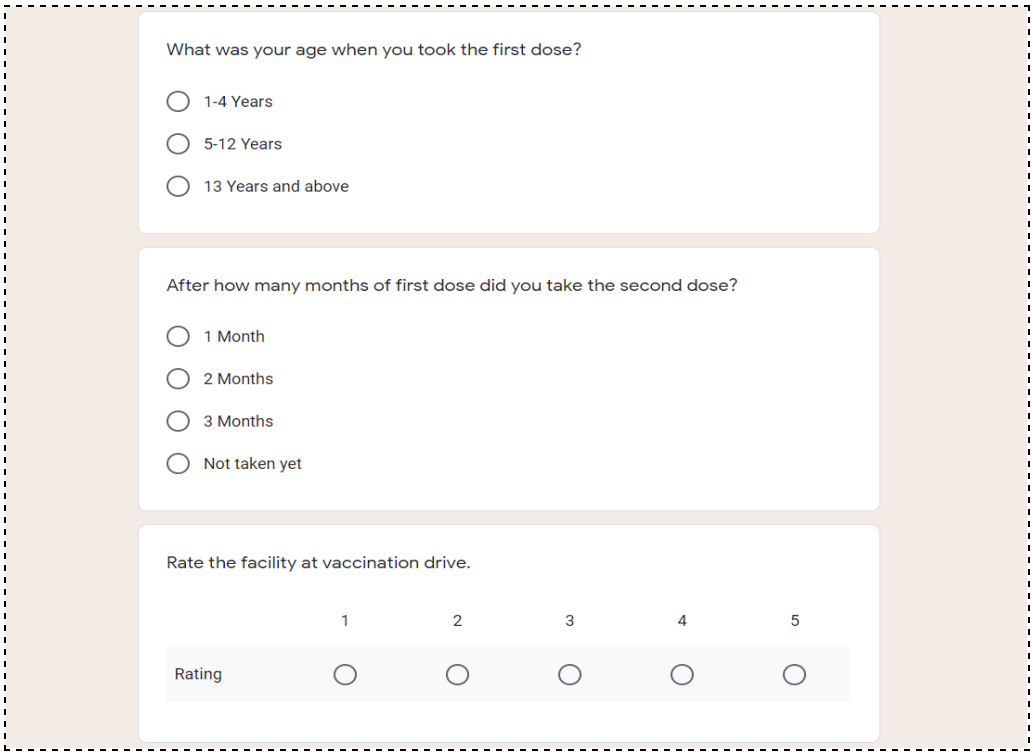
- Not Taken
- Both doses
- 1 dose

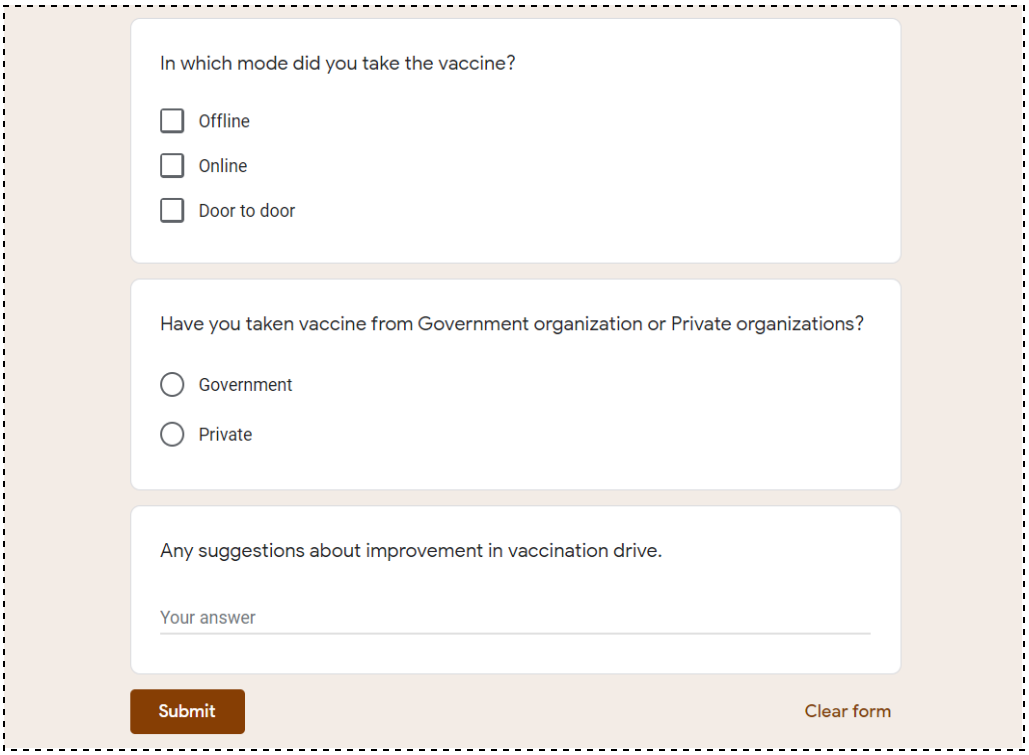
In which age group do you belong? *

- 5-12 Years
- 13 Years and above
- 1-4 Years

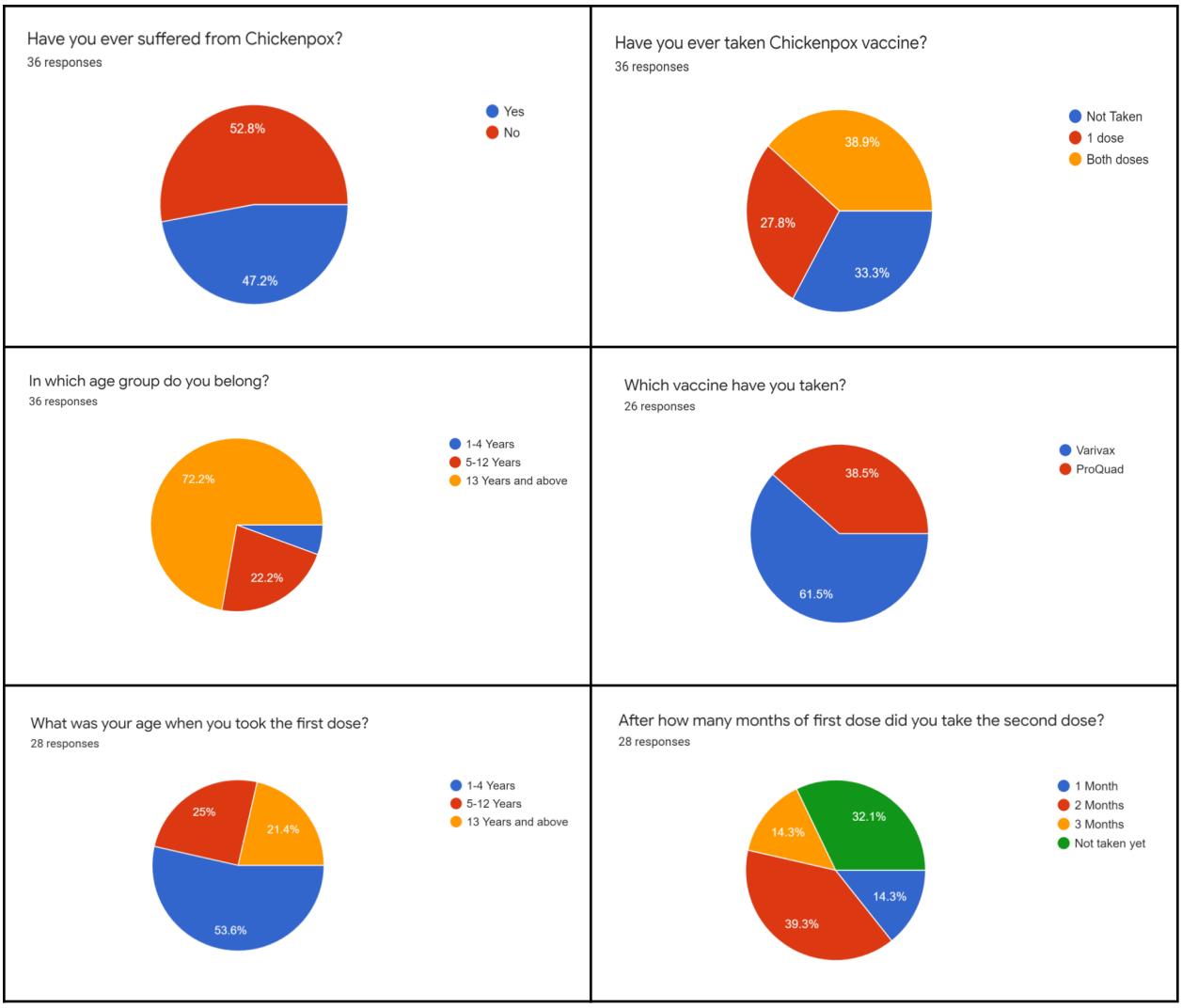
Which vaccine have you taken?

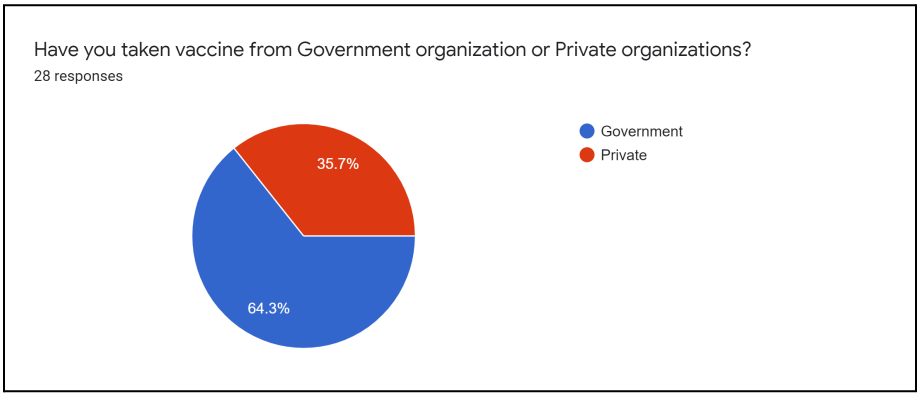
- Varivax
- ProQuad

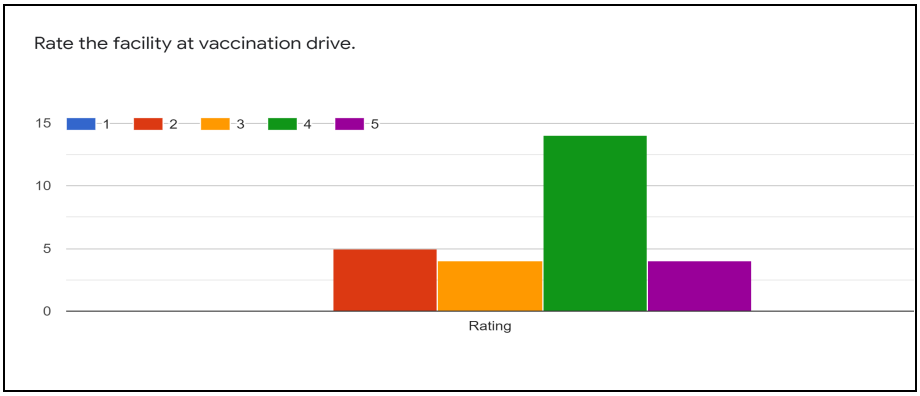

What was your age when you took the first dose?
1-4 Years
5-12 Years
13 Years and above
After how many months of first dose did you take the second dose?
1 Month
2 Months
3 Months
Not taken yet
Rate the facility at vaccination drive.
1
2
3
4
5
Rating

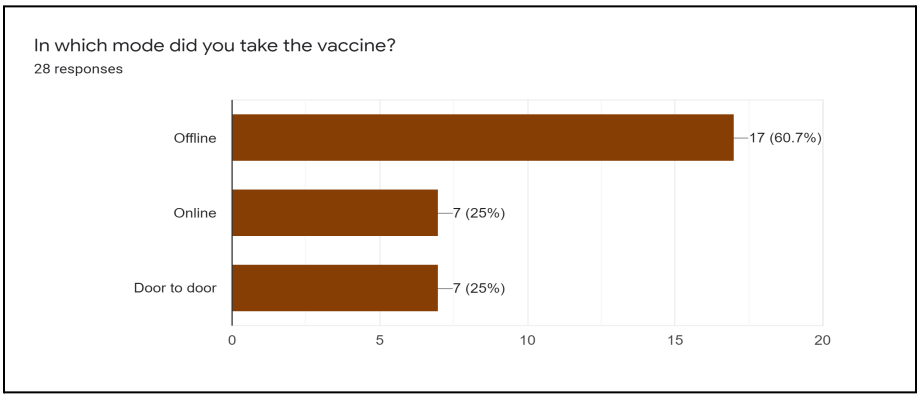

In which mode did you take the vaccine?
Offline
Online
Door to door
Have you taken vaccine from Government organization or Private organizations?
Government
Private
Any suggestions about improvement in vaccination drive.
Your answer
Submit
Clear form

Graphs and Inferences :









- The people who have taken vaccines are rarely encountered with chickenpox.
- More than half the people surveyed have been affected by chickenpox.
- More than 60% of people have taken the vaccine.
- Audience prefers offline vaccination.
- The audience prefers government vaccination centers as compared to private organisations.
- Door-to-door survey has been conducted successfully, covering 25% of people.

Requirements from Questionnaire:

- To find how many users take vaccines on time
- To find how much improvement is needed in vaccination center services
- To find if users prefer government or private organisation to take vaccine
- To find how many users have suffered from Chickenpox

4) Observations :

Vaccine Drive Management: Observations

System: Vaccination Drive Management

Project Reference: SF/SJ/2020/14

Observations By:

Date: 1/10/2021 **Time:** 11:30 AM

Duration: 40 minutes **Place:** Vaccine center

Observations:

- Center should have the facility to consult doctors in such cases.
- In some cases if a child is not there with the parent at the vaccination center then based on the child's identity registration can be confirmed.
- Vaccination centers should be neat and clean for the hygiene purpose.
- After registering online, people come to the vaccination center but they have to wait for a long time in the queue.
- In offline registration, beneficiaries do not get a vaccination certificate in real-time as it would be generated after the data is updated on the vaccine management portal.
- Identity proof specified by you at the time of registration on the portal and a printout/screenshot of your appointment slip should be carried by you.
- Facility to users to cancel/reschedule their appointment is given for a fixed number of times
- The vaccinated people should stay at the center itself for half an hour to ensure there are no side-effects from the vaccination, if there occurs any issue they should be able to contact the doctors available at the center.
- Management should somehow regulate the price of vaccines at private centers.
- To show vaccination centers based on locality - pincode or area name etc.

Requirements from Observation:

- To give details of consulting doctors
- To ensure efficient use of slot timings.
- To keep users at the vaccination center for sometime after taking the vaccine so that side effects can be tackled.

Create Fact-Finding Chart

Objective	Technique(s)	Subjects	Time
To get all the details of the user while registering	Background Reading	Registration Aspect	1 day
To implement constraint in such manner so that registration is based on unique identity	Interview	User requirements	1.25 hours
To understand about the preferences of users from online/offline/door-to-door mode	Background Reading	Registration Aspect	0.5 day
To see that person is eligible to take the vaccine. Priority classes should get higher preference	Background Reading	Staff Responsibility	0.5 day
To implement method so that user don't have to wait in queue for longer (set slots capacity)	Interview	User requirements	1.25 hours
To find how many users take vaccines on	Questionnaire	User	2 days

time		requirements	
To record the number of doses of vaccines available, in real-time	Background Reading	Administrator Management	1 hour
To give details of consulting doctors	Observation	Vaccine drive management	2 hours
To implement choice for user preference	Interview	User requirements	1.25 hours
To assure that people registering for 2nd dose have already taken 1st dose	Background Reading	Staff Responsibility	3 hours
To assure efficient working of app with slot details	Background Reading	Administrator Management	0.5 day
To see that vaccines do not get wasted	Background Reading	Vaccine drive management	1 hour
To add unique vaccine id	Interview	User requirements	1.25 hours
To give user details of person from them they are taking their vaccine	Interview	User requirements	1.25 hours
To provide the slot rescheduling facility	Background Reading	User Facility	1 day
To find how much improvement is needed in vaccination center services	Questionnaire	Vaccine drive management	2 days
To show the price of vaccine while registering privately	Background Reading	Administrator Management	2 hours
To provide adequate staff at each vaccination center	Background Reading	Vaccine drive management	1.5 hours
To ensure efficient use of slot timings. So slots should be divided accurately	Observation	Vaccine drive management	2 hours
To provide selection of vaccination centers of convenience	Background Reading	User requirements	1.25 hours
To schedule vaccination date as per slot availability at a center	Background Reading	Vaccine drive management	0.5 day
Updation of user's registered data (if required)	Interview	User requirements	1.25 hours
To implement registration in such manner so that they can register again (for user which are registering online if pre-booked slots are missed)	Interview	User requirements	1.25 hours

To manage patient queues and waitlists based on custom criteria, and set priorities	Background Reading	Vaccine drive management	1 day
To set a unique user id that identifies user uniquely	Interview	Management requirements	1.5 hours
To prohibit online registration - If the user is not able to reach in a given time slot for more than three times	Interview	Management requirements	1.5 hours
To provide unique e-certificate id using which user can access e-certificate from the corresponding website	Interview	Management requirements	1.5 hours
To manage remaining and wasted vaccines	Interview	Management requirements	1.5 hours
To provide dynamic online slots according to staff capacity of center and approximate idea of offline registrations	Interview	Management requirements	1.5 hours
To determine the staff capacity of each centers and allocate staff accordingly	Interview	Management requirements	1.5 hours
To determine staff utilisation at the end of each day which will help to transfer, remove or add staff members from different centers	Interview	Management requirements	1.5 hours
To give E-certificate id	Interview	User requirements	1.25 hours
To show vaccination centers based on locality - pincode or area name etc.	Interview	User requirements	1.25 hours

Requirements

- To get all the details of the user while registering (x3)
- To provide unique e-certificate id using which user can access e-certificate from the corresponding website (x2)
- To give details of consulting doctors (x2)
- To understand about the preferences of users from online/offline/door-to-door mode (x2)
- To show vaccination centers based on locality - pincode or area name etc.(x2)
- To give user, the details of staff member from whom they are taking their vaccine (x2)
- To implement constraint in such manner so that registration is based on unique identity (x1)

- To provide dynamic online slots according to staff capacity of center and approximate idea of offline registrations (x1)
- To prohibit online registration - If the user is not able to reach in a given time slot for more than three times (x1)
- To implement method so that user don't have to wait in queue for longer (set slots capacity) (x1)
- To find how many users take vaccines during a given slot. (x1)
- To record the number of doses of vaccines available, in real-time (x1)
- To assure that people registering for 2nd dose have already taken 1st dose (x1)
- To add unique vaccine id (x1)
- To determine staff utilisation (x1)
- To provide the slot rescheduling facility before 12 hours (x1)
- To show the price of vaccine while registering privately (x1)
- To update of user's registered data (if required) (x1)
- To provide the staff capacity of each centers (x1)
- To manage remaining and wasted vaccines(x1)
- To regulate the price of vaccines at private centers.(x1)

User Classes and Characteristics

The software includes specific classes pertaining to differential classes like:

- **Administrator:** In the system, the role of the Administrator is to supervise the staff, manage the user and staff requirements, manage vaccine stocks and storage. Each center will have administrators to run the drive successfully.
- **Staff:** In the system, staff includes three different types of people.
    1. The people who will take care of the registration and certification related tasks.
    2. Health care staff. The people who will give vaccines to users. The staff in this category should necessarily have the nursing degree or should have adequate medical knowledge and experience.
    3. The doctors. If any emergency will occur then people can consult them.
- **User:** In the system, the role of the user is like a normal person .User is one who is getting vaccinated or a guardian of a vaccinating child. Users can register online/offline themselves in private/government centers and get vaccinated. In specific cases users also have a facility for door-to-door vaccination. Every vaccinated user will have a unique e-certificate for confirmation of vaccination.

  Different age groups:

    - Age group -1 : People 1-4 years.
    - Age group -2 : People 5-12 years.
    - Age group -3 : People of age 13 years and older.

Operating Environment

- The software used is pgAdmin. It is used to perform any sort of database administration required for a Postgres database.
- The system is a Windows 64 machine.
- The application/software should be such that it works efficiently in a heavy load environment.
- This vaccination software stores, analyses and keeps track of data limited to a well developed urban city.
- The app or vaccine management website should be compatible with other systems and work consistently with them.

Product Functions

- The software being specified provides slot booking. It provides multiple slot timings throughout the working days and weekends.
- Keeps track of registered people and registration details. Registration will be based on unique identity.
- The slots can be booked both online, offline, and door-to-door for private organisations.
- Choice is provided for the vaccine they want to take based on availability. (From 2 certified chickenpox vaccines.)
- Keeps track of fully and partially vaccinated people.
- Keeps track of requirements of vaccines at different centers.
- Keeps track of price of vaccines and profit earned by private sectors.
- Keeps track of management staff, health care staff, consulting doctors etc.
- **Provides dynamic online slots.**
- Keeps track of how many users take vaccines during a given slot.
- Assures that people registering for 2nd dose have already taken 1st dose
- **Provide the slot rescheduling facility before 12 hours**
- Show the price of vaccine while registering privately
- Updates the user's registered data (if required)
- **Prohibits online registration - If the user is not able to reach in a given time slot for more than three times**
- Provide unique e-certificate id using which user can access e-certificate from the corresponding website
- **Provides vaccination center details based on locality - pincode or area name etc.**
- D**etermines staff utilisation at the end of each day which will help to transfer, remove or add staff members from different centers**

Privileges

User Classes	Accessible classes	Read	Insert	Update	Delete
Administrator	Administrator	Yes	No	No	No
	Staff	Yes	Yes	Yes	Yes
	User	Yes	Yes	Yes	Yes
Staff	Staff	Yes	No	No	No
	User	Yes	Yes	Yes	Yes
User	None	-	-	-	-

Assumptions

- The software assumes that each center has adequate staff for managing the vaccination drives during different slots.
- It assumes that the staff is well qualified and works in the interest of patients.
- It assumes that the center has enough material resources like a facility for storing vaccines, adequate number of syringes, etc.
- The vaccine provided is in good condition and not the past expiry date.
- Transportation of vaccines to different centers is available at any given time.
- Employees do not have issues towards working in any vaccination center.

Business Constraints

Business constraint defines business rules or business policy. Each organization has specific rules about the data store.
Some Common business constraints include:

Time Constraints:

- Time constraints include not only the amount of time required to complete a task, but also the amount of time needed to obtain supplies.
- Once identified as a primary constraint, management can take steps to address time factors and improve vaccination performance. For example, larger supply orders might reduce time constraints imposed by long wait times. Similarly, allocating more space to vaccination centers might allow more people to be vaccinated, thereby reducing the total time needed to vaccinate the whole urban city.

Management and Staffing:

- As the vaccination process grows, their staffing and management needs change, as well.
- This can constrain vaccination growth and productivity when staff cannot adapt to new demands.
- Management needs also change over time and sometimes poor management constrains growth by allocating resources inappropriately.

Financial Constraints:

- Capital to run the system may provide delay in the functioning of the system.
- If the allocation of salaries to staff takes time, there may be worker strikes and the system gets shut down.

Section2:

Noun Analysis

Table 1: Noun and Verb Analysis

Nouns	Verbs
Registration ID	Center Stock
Varivax	Rescheduling
Citizen	Confirmation
Portal	Allocated staff
User ID	Consultant
Vaccine ID	register
e-portal	First dose details
Proquad	responsible
Chicken pox	Offline Approximation Analysis
Vaccine name	Administrator
Registration mode	Update user data
Center ID	Registered slots
Dose	Staff Utilization
Slot ID	Limit Registration
Pincode	scheduling
Emergency	Consulting doctors
Registered time and date	Registered user
User ID	Scheduling Appointment
appointment	Vaccination slot
area name	Second dose details
date	Registered slots
Registration	First dose details
User name	Allocated staff
User age	Consultant
User gender	Registered center

time	
User address	
door-to-door appointment	
User phone number	
User guardian	
Center id	
e-certificate	
People	
registering	
2nd dose	
1st dose	
Center name	
offline	
Center address	
vaccine	
online	
Employee id	
first dose	
Employee Name	
Center type	
Vaccine price	
Doctor ID	
Second dose	
Doctor Email	
Admin Landline Number	
Employee type	
Admin ID	
Maximum staff Capacity	

Slot ID	
Vaccination center	
time	
date	
day	
Online registration capacity	
Offline approximate registration	
E certificate ID	
Vaccine ID	
Staff ID	
Center ID	
date	
Vaccine ID	
Staff ID	
reg_id	
Attended users	
E-certificate ID	
Varivax vaccine	
Proquad vaccine	
Date	
Remaining proquad vaccines	
Remaining Varivax vaccines	
Wasted vaccines	
Doctor id	
Doctor name	
Doctor number	
Admin ID	
Admin name	

Admin number	
Staff ID	
Staff name	
Staff type	
Wasted Vaccine	
Number of doses	
Staff members	
Centers	
Employee number	

Table 2:Accepted Noun & Verbs list

Candidate Entity Set	**Candidate Attribute Set**	**Candidate Relationship set**
User	Staff ID	Consultant
Vaccination center	Maximum staff Capacity	Registered slots
Stock Details	Center ID	Allocated staff
Doctor Details	Center Name	Administrator
Admin Details	Center Address	Registered Users
Registration Details	Center Type	Offline approximation analysis
Slots	Vaccine Price	Center Stock
Staff Details	Staff Name	Vaccine dose details
Employee	Time	Registered center
	Date	
	Day	
	Proquad Vaccine	
	Online Registration Capacity	
	User ID	
	User Name	

	User age	
	Admin Landline	
	Employee ID	
	Doctor Email	
	User Gender	
	User address	
	User Phone number	
	Staff type	
	User Guardian	
	Vaccine Name	
	Employee type	
	Employee Name	
	Employee number	
	Wasted Vaccine	
	Registration ID	
	Varivax Vaccine	
	Vaccine ID	
	Date	
	Remaining Proquad Vaccine	
	Remaining Varivax Vaccine	
	Registration Mode	
	Center ID	
	Dose	
	Registration Time and Date	

Table 3: Rejected Noun & Verbs list

Noun	Rejected reason
Varivax	Irrelevant
Citizen	General
e-portal	Irrelevant
Slot ID	Duplicate
Proquad	Irrelevant
Chicken pox	General
Dose	General
door-to-door appointment	Attribute
Pincode	Irrelevant
People	Vague
Emergency	General
appointment	General
area name	General
offline	General
Registration	Association
User ID	Duplicate
Vaccine ID	Duplicate
center	General
online	Attribute
Staff ID	Duplicate
Center ID	Duplicate
Date	Duplicate
Time	Duplicate
First dose	Duplicate
Second dose	Duplicate

Doctor ID	Duplicate
Doctor name	Duplicate
Doctor number	Duplicate
Staff ID	Duplicate
Staff Name	Duplicate
Admin ID	Duplicate
Admin Name	Duplicate
Admin Number	Duplicate

Verbs	**Rejected reason**
Rescheduling	General
Confirmation	Irrelevant
Consultant	Duplicate
Register	Vague
First dose details	Duplicate
responsible	Irrelevant
Update user data	Irrelevant
Registered slots	Duplicate
Staff Utilization	General
Limit Registration	Irrelevant
scheduling	Duplicate
Consulting doctors	Duplicate
Scheduling Appointment	Duplicate
Vaccination slot	General

II) Development of ER diagram

Note: For each candidate entity set, details in the bracket of the candidate relationship set indicates the relationship with that particular entity set.

Candidate Entity Set	**Candidate Attribute Set**	**Candidate Relationship set**
Vaccination center	Center ID Center Name Center Address Center Type Vaccine Price Maximum staff Capacity	Administrator (Admin details) Consultant (Doctor details) Center Stock (Stock Details) Offline approximation analysis (slots) Allocated staff (Staff Details) Registered center (Registration details)
Slots	Slot ID Time Date Day Online Registration Capacity	Registered slots (Registration details) Offline approximation analysis (Vaccination center)
User	User Id User Name User Age User Gender User Address User Phone Number User Guardian	Registered user (Registration details)
Registration Details	Registration ID Vaccine Name Registration Mode Center ID Dose Registration Time and Date	Registered slots (slots) Registered Users (Users) Registered center (Vaccination center) Vaccine dose details (Staff Details)
Staff Details	Staff type	Allocated staff (Vaccination center) Vaccine dose details (Registration details)
Doctor Details	Doctor Email	Consultant (Vaccination center)
Stock Details	Date Proquad Vaccine Varivax Vaccine Remaining Proquad Vaccine Remaining Varivax Vaccine Wasted Vaccine	Center stock (Vaccination center)
Admin Details	Admin landline number	Administrator (Vaccination center)
Employee	Employee ID Employee Name Employee Number Employee Type	

Section3:

ER-Diagrams all versions

Finalizing ER diagrams.

Identify weak entity sets:

Weak Entity set	Identifier Entity set	Identifier Entity
Stock details	Vaccination center	Center ID

Identify Hierarchy:

Parent (Higher level Entity set)	Child (Higher level Entity set)
Employee	Doctor details
	Admin details
	Staff details

Identify association types:

Relationship	Association type
Center Stock (Stock details to Vaccination center)	Many to one
Consultant (Doctor details to Vaccination center)	One to one
Offline Approx Analysis (Slots to Vaccination center)	Many to many
Administrator (Admin details to Vaccination center)	One to one
Allocated Staff (Staff details to Vaccination center)	Many to many
Registered User (Registration details to slots)	Many to one
Vaccine dose details (Registration details to staff details)	Many to many
Registered center (Registration details to vaccination center)	Many to one
Registered Slots (Slots to Registration details)	One to many

Identify Relationship types:

Entity vs Attributes:

Here doctor details and admin details can be selected as attributes in the vaccination center also, but we have taken them both as entity sets so that we can allow extra information pertaining to them.

Entity vs Relationship Set:

Allocated staff can be taken as an entity set instead of a relationship set. But to decrease redundancy, we have taken allocated staff as a relationship set between vaccination center and staff details. The associated attributes with the allocated staff relationship set are date and attended users.

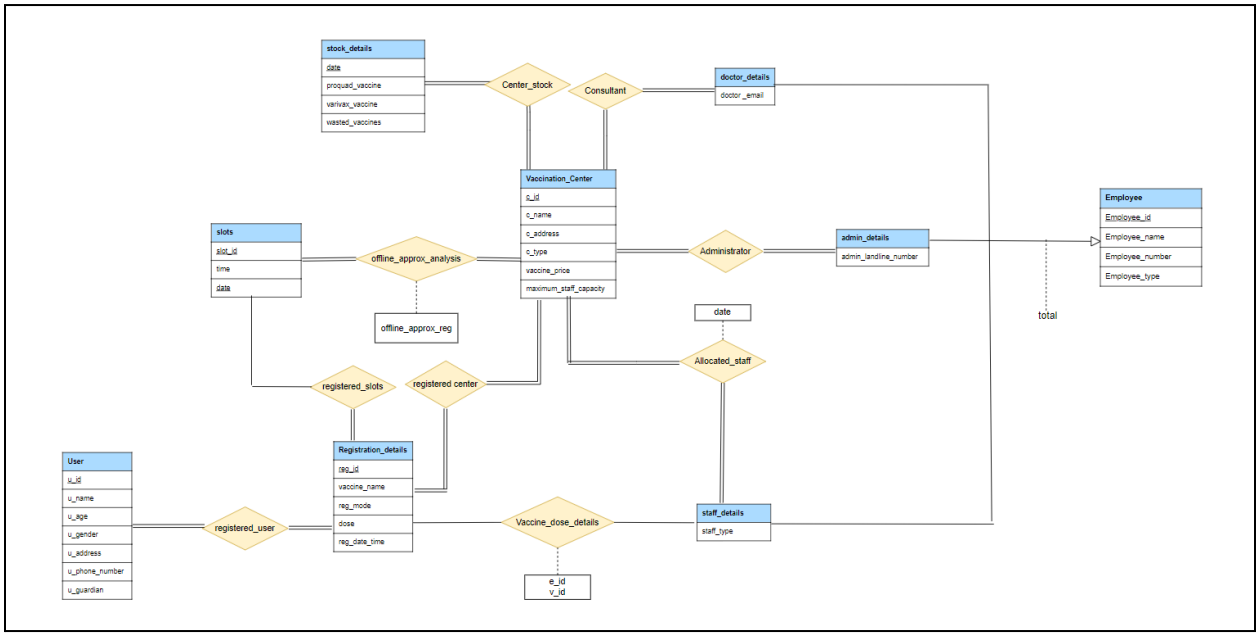
Participation:

Relationship	Participation
Center Stock (Stock details to Vaccination center)	Total
Consultant (Doctor details to Vaccination center)	Total
Offline Approx Analysis (Slots to Vaccination center)	Total
Administrator (Admin details to Vaccination center)	Total
Allocated Staff (Staff details to Vaccination center)	Total
Registered User (Registration details to slots)	Total
Vaccine dose details (Registration details to staff details)	Partial
Registered center (Registration details to vaccination center)	Total
Registered Slots (Slots to Registration details)	Slots Partial Registration details total

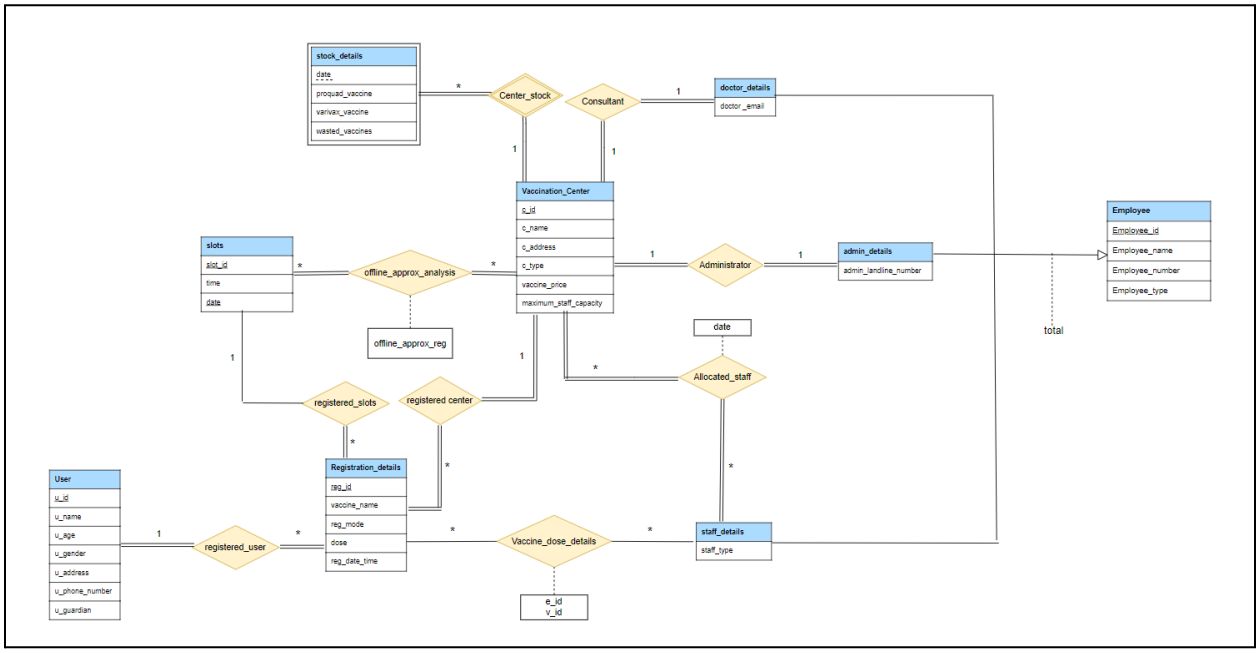
.

E-R diagrams:

Version 1:



Version 2 (final):



Section 4:

Conversion of Final ER-Diagram to Relational Model

Mapping E-R Model to Relational Model

- user (u_id, u_name, u_age, u_gender, u_address, u_phone_number, u_guardian)
- registration_details (reg_id, u_id,slot_id, date, vaccine_name, reg_mode, c_id, dose, reg_date_time)
- vaccine_dose_details (reg_id, employee_id, e_id, v_id)
- stock_details (c_id, date, proquad_vaccine, varivax_vaccine, wasted_vaccine)
- slots (slot_id, date, time)
- vaccination_center (c_id, c_name, c_address, c_type, vaccine_price, maximum_staff_capacity)
- staff_details (employee_id, staff_type)
- allocated_staff (employee_id, c_id, date)
- offline_ approx_analysis (slot_id, date, c_id, offline_approx_reg)
- doctor_details (employee id, c_id, doctor_email)
- admin_details (employee_id, c_id, admin_landline_number)
- employee (employee_id, employee_name, employee_type, employee_number)

Section 5:

Normalization and Schema Refinement

Existing Schema:

- user (u_id, u_name, u_age, u_gender, u_address, u_phone_number, u_guardian)
- registration_details (reg_id, u_id,slot_id, date, vaccine_name, reg_mode, c_id, dose, reg_date_time)
- vaccine_dose_details (reg_id, employee_id, e_id, v_id)
- stock_details (c_id, date, proquad_vaccine, varivax_vaccine, wasted_vaccine)
- slots (slot_id, date, time)
- vaccination_center (c_id, c_name, c_address, c_type, vaccine_price, maximum_staff_capacity)
- staff_details (employee_id, staff_type)
- allocated_staff (employee_id, c_id, date)
- offline_ approx_analysis (slot_id, date, c_id, offline_approx_reg)
- doctor_details (employee id, c_id, doctor_email)
- admin_details (employee_id, c_id, admin_landline_number)
- employee (employee_id, employee_name, employee_type, employee_number)

Dependencies (PK, FK, Functional Dependencies) for each relation:

PK Dependency
u_id → u_name, u_age, u_gender, u_address, u_phone_number, u_guardian
reg_id → u_id,slot_id, date, vaccine_name, reg_mode, c_id, dose, reg_date_time
{reg_id, employee_id} → e_id, v_id
c_id → c_name, c_address, c_type, vaccine_price, maximum_staff_capacity
{slot_id, date} → time
{c_id, date}→ proquad_vaccine, varivax_vaccine, wasted_vaccine
employee_id → staff_type
employee_id→ c_id, admin_landline_number
{slot_id, date, c_id} → offline_approx_reg
employee id→ c_id, doctor_email
employee_id → employee_name, employee_type, employee_number

Functional Dependency
e_id → v_id
slot id → time
reg_id→ e_id, v_id

Redundancies and anomalies:

Relation slots:

Redundancy : The same date is repeated for different slot_id and different times.
For different dates, the same slot_id and time are repeated.
Anomalies:
Insert : We can not insert a slot time unless it is not assigned to a date.
Update : To update timing of a slot_id, we will have to update timings for all the dates.
Delete : If we delete tuples for a particular date, timing information of the slot will also be deleted.

Relation vaccine_dose_details:

Redundancy : The details like e_id, v_id and reg_id will be repeated for the details of different types of employees associated with the user (employee_id).
Anomalies:
Insert : We can not insert dose details unless it is assigned to an employee.
Update : To update dose details, we will have to update it for every employee_id associated with that registration.
Delete : If we delete a tuple for a particular employee_id, other dose details associated with that employee_id will also be deleted.

The above anomalies and redundancies are due to partial dependencies which will be removed in 2NF form.

Normalization of the database up to 1NF (scalar values)

Composite attributes:

- In relation slots, time contains a time range : start_time : end_time
- In relation registration_details, reg_date_time contains : reg_date and reg_time.

Due to these composite attributes we cannot retrieve the data we want easily. For retrieving that particular data we have to extract the data from the composite data.

To normalize schema up to 1NF form: we can divide the attributes into two parts.
New, relations will be: slots (slot_id, date, start_time, end_time)
and registration_details (reg_id, u_id,slot_id, date, vaccine_name, reg_mode, c_id, dose, reg_date, reg_time).

Schema in 1NF form:

- user (u_id, u_name, u_age, u_gender, u_address, u_phone_number, u_guardian)
- registration_details (reg_id, u_id,slot_id, date, vaccine_name, reg_mode, c_id, dose, reg_date, reg_time)
- vaccine_dose_details (reg_id, employee_id, e_id, v_id)
- stock_details (c_id, date, proquad_vaccine, varivax_vaccine, wasted_vaccine)
- slots (slot_id, date, start_time, end_time)
- vaccination_center (c_id, c_name, c_address, c_type, vaccine_price, maximum_staff_capacity)
- staff_details (employee_id, staff_type)
- allocated_staff (employee_id, c_id, date)
- offline_ approx_analysis (slot_id, date, c_id, offline_approx_reg)
- doctor_details (employee id, c_id, doctor_email)
- admin_details (employee_id, c_id, admin_landline_number)
- employee (employee_id, employee_name, employee_type, employee_number)

There are still anomalies and redundancy related to partial dependencies in 1NF form which were also there before 1NF form.

Relation slots:

Redundancy : The same date is repeated for different slot_id and different times.
For different dates, the same slot_id and time are repeated.
Anomalies:
Insert : We can not insert a slot time unless it is not assigned to a date.
Update : To update timing of a slot_id, we will have to update timings for all the dates.
Delete : If we delete tuples for a particular date, timing information of the slot will also be deleted.

Relation vaccine_dose_details:

Redundancy : The details like e_id, v_id and reg_id will be repeated for the details of different types of employees associated with the user (employee_id).
Anomalies:
Insert : We can not insert dose details unless it is assigned to an employee.
Update : To update dose details, we will have to update it for every employee_id associated with that registration.
Delete : If we delete a tuple for a particular employee_id, other dose details associated with that employee_id will also be deleted.

Normalization of the database further to 2NF (Remove Partial Dependencies)

- In the slots table, the attributes ‘start_time’ and ‘end_time’ depends only on ‘slot _id’
  Slots table will be decomposed into two tables:
  slots_time(slot_id, start_time, end_time) and slots(slot_id, date)
- In the vaccine_dose_details table, the attribute ‘e_id’ and ‘v_id’ depend only on ‘reg_id’
  vaccine_dose_details table will be decomposed into two tables:
  vaccine_employee(reg_id, employee_id) and vacccine_dose_details(reg_id,e_id,v_id)

List of redundancies exiting for the schema in 2NF

- There are no such redundancies existing for schema in 2NF and there are no anomalies.

Normalization of the database further to 3NF/BCNF (Remove Transitive Dependencies)

- All the non prime attributes are directly depending on the primary key in the 2NF schema.
- So, there are no transitive dependencies. Hence, the schema is in 3NF form.
- Also, Primary keys are not dependent on non-prime attributes in any relation and hence, schema is in BCNF form.

Final Schema (BCNF)

- user (u_id, u_name, u_age, u_gender, u_address, u_phone_number, u_guardian)
- registration_details (reg_id, u_id,slot_id, date, vaccine_name, reg_mode, c_id, dose, reg_date, reg_time)
- slots_time(slot_id,start_time,end_time)
- slots(slot_id, date)
- vaccine_employee(reg_id, employee_id)
- vacccine_dose_details(reg_id,e_id,v_id)
- stock_details (c_id, date, proquad_vaccine, varivax_vaccine,wasted_vaccine)
- vaccination_center (c_id, c_name, c_address, c_type, vaccine_price, maximum_staff_capacity)
- staff_details (employee_id, staff_type)
- allocated_staff (employee_id, c_id, date)
- offline_ approx_analysis (slot_id, date, c_id, offline_approx_reg)
- doctor_details (employee id, c_id, doctor_email)
- admin_details (employee_id, c_id, admin_landline_number)
- employee (employee_id, employee_name, employee_type, employee_number)

Section6:

SQL: Final DDL Scripts, Insert statements, 40 SQL Queries with Snapshots of output of each query

Final DDL Scripts

Order in which tables are created:

- user
- slots_time
- slots
- Vaccination_center
- Registration_details
- Employee
- Staff_details
- Vaccine_dose_details
- Vaccine_employee
- stock_details
- allocated_staff
- offline_approx_analysis
- Doctor_details
- Admin_details

user:

```
CREATE TABLE “user”
(
   u_id bigint NOT NULL,
   u_name character(20) NOT NULL,
   u_age numeric(4,2) NOT NULL,
   u_gender "char" NOT NULL,
   u_address character varying(100),
   u_phone_number character(15) NOT NULL,
   u_guardian character(20),
   PRIMARY KEY (u_id)
)
```

slots_time:

```
CREATE TABLE “slots_time”
(
        slot_id integer NOT NULL,
        start_time time without time zone NOT NULL,
        end_time time without time zone NOT NULL,
        PRIMARY KEY (slot_id)
)
```

slots:

```
CREATE TABLE “slots”
(
    slot_id integer NOT NULL,
    date date NOT NULL,
    PRIMARY KEY (slot_id, date),
    FOREIGN KEY (slot_id) REFERENCES slots_time(slot_id)
        ON UPDATE cascade
      ON DELETE cascade
)
```

vaccination_center:

```
CREATE TABLE “vaccination_center”
(
    c_id bigint NOT NULL,
    c_name character(25) NOT NULL,
    c_address character(10) NOT NULL,
    c_type character(10) NOT NULL,
    vaccine_price numeric(6, 2) NOT NULL,
    max_staff_capacity integer,
    PRIMARY KEY (c_id)
)
```

registration_details:

```
CREATE TABLE “registration_details”
(
    reg_id bigint NOT NULL,
    u_id bigint NOT NULL,
    slot_id integer NOT NULL,
    date date NOT NULL,
    vaccine_name character(15) NOT NULL,
    reg_mode character(15) NOT NULL,
    c_id integer NOT NULL,
    dose "char"  NOT NULL,
    reg_date date NOT NULL,
    reg_time time without time zone NOT NULL,
    PRIMARY KEY (reg_id),
    FOREIGN KEY (date, slot_id) REFERENCES slots (date, slot_id)
        ON UPDATE cascade
      ON DELETE NO ACTION,
    FOREIGN KEY (c_id) REFERENCES vaccination_center (c_id)
        ON UPDATE cascade
      ON DELETE NO ACTION,
```

```
    FOREIGN KEY (u_id) REFERENCES user (u_id)
        ON UPDATE cascade
      ON DELETE NO ACTION,
    CHECK (dose in ('1' , '2'))
  )
```

employee:

```
CREATE TABLE “employee”
(
  employee_id bigint NOT NULL,
  employee_name character(20) NOT NULL,
  employee_type character(20) NOT NULL,
  employee_number character(15) NOT NULL,
  PRIMARY KEY (employee_id)
)
```

staff_details:

```
CREATE TABLE “staff_details”
(
  employee_id bigint NOT NULL,
  staff_type character(20) NOT NULL,
  PRIMARY KEY (employee_id),
  FOREIGN KEY (employee_id) REFERENCES employee (employee_id)
      ON UPDATE cascade
      ON DELETE cascade
)
```

vaccine_dose_details:

```
  CREATE TABLE “vaccine_dose_details”
  (
    reg_id bigint NOT NULL,
    e_id bigint NOT NULL,
    v_id bigint NOT NULL,
    PRIMARY KEY (reg_id),
    FOREIGN KEY (reg_id) REFERENCES registration_details (reg_id)
        ON UPDATE cascade
      ON DELETE NO ACTION
   )
```

vaccine_employee:

```
CREATE TABLE “vaccine_employee”
(
   reg_id bigint NOT NULL,
   employee_id bigint NOT NULL,
   PRIMARY KEY (reg_id, employee_id),
   FOREIGN KEY (employee_id) REFERENCES staff_details (employee_id)
         ON UPDATE cascade
         ON DELETE NO ACTION,
   FOREIGN KEY (reg_id) REFERENCES registration_details (reg_id)
           ON UPDATE cascade
         ON DELETE NO ACTION,
   FOREIGN KEY (reg_id) REFERENCES vaccine_dose_details (reg_id)
           ON UPDATE cascade
         ON DELETE NO ACTION
)
```

stock_details:

```
   CREATE TABLE “stock_details”
   (
      c_id bigint NOT NULL,
      date date NOT NULL,
      proquad_vaccine bigint NOT NULL,
      varivax_vaccine bigint NOT NULL,
      wasted_vaccines integer NOT NULL,
      PRIMARY KEY (c_id, date),
     FOREIGN KEY (c_id) REFERENCES vaccination_center (c_id)
         ON UPDATE cascade
         ON DELETE NO ACTION
   )
```

allocated_staff:

```
CREATE TABLE “allocated_staff”
(
   employee_id bigint NOT NULL,
   c_id bigint NOT NULL,
   date date NOT NULL,
   PRIMARY KEY (employee_id, c_id,date),
   FOREIGN KEY (c_id) REFERENCES vaccination_center (c_id)
         ON UPDATE cascade
         ON DELETE NO ACTION,
    FOREIGN KEY (employee_id) REFERENCES staff_details (employee_id)
         ON UPDATE cascade
         ON DELETE NO ACTION
)
```

offline_ approx_analysis:

```
CREATE TABLE “offline_approx_analysis”
(
   slot_id integer NOT NULL,
   date date NOT NULL,
   c_id bigint NOT NULL,
   offline_approx_reg integer NOT NULL,
   PRIMARY KEY (slot_id, date, c_id),
   FOREIGN KEY (date, slot_id) REFERENCES slots (date, slot_id)
         ON UPDATE cascade
         ON DELETE cascade,
   FOREIGN KEY (c_id) REFERENCES vaccination_center (c_id)
         ON UPDATE cascade
         ON DELETE cascade
)
```

doctor_details:

```
CREATE TABLE “doctor_details”
(
   employee_id bigint NOT NULL,
   c_id bigint NOT NULL,
   doctor_email character(50),
   PRIMARY KEY (employee_id),
   FOREIGN KEY (c_id) REFERENCES vaccination_center (c_id)
         ON UPDATE cascade
         ON DELETE NO ACTION,
   FOREIGN KEY (employee_id) REFERENCES employee (employee_id)
         ON UPDATE cascade
         ON DELETE cascade
)
```

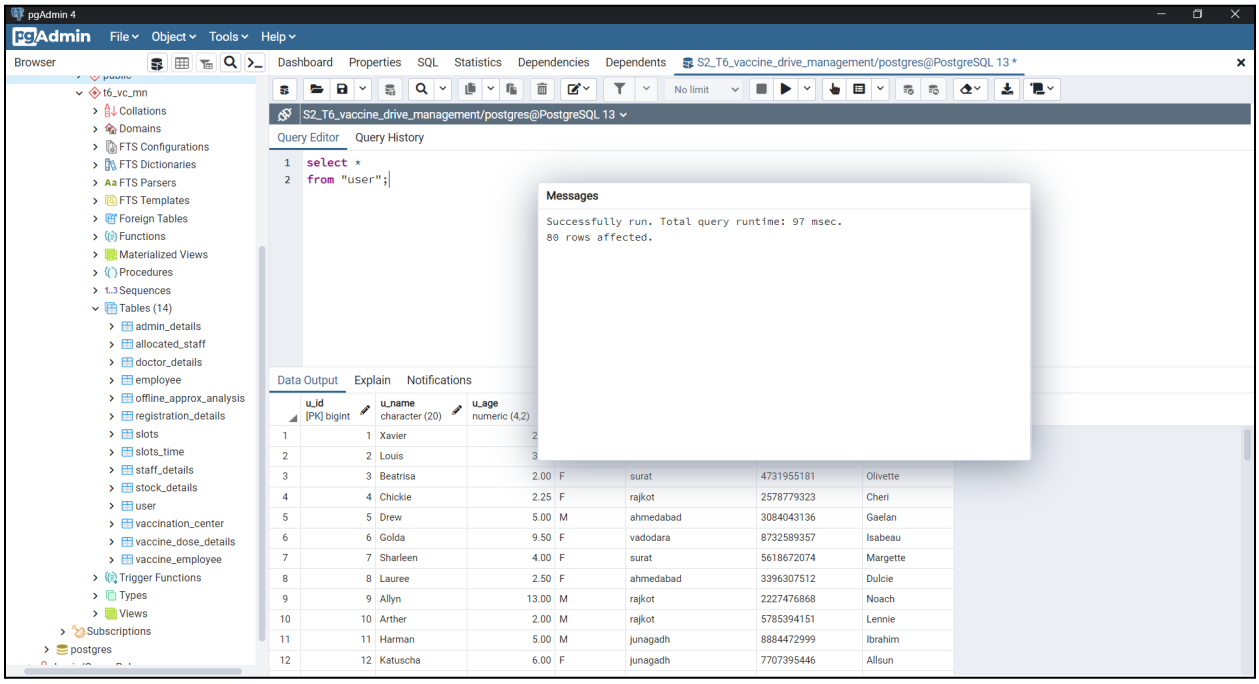
admin_details:

```
CREATE TABLE “admin_details”
(
   employee_id bigint NOT NULL,
   c_id bigint NOT NULL,
   landline_number character(15) NOT NULL,
   PRIMARY KEY (employee_id),
   FOREIGN KEY (c_id) REFERENCES vaccination_center (c_id)
         ON UPDATE cascade
         ON DELETE NO ACTION,
```

```
  FOREIGN KEY (employee_id) REFERENCES employee (employee_id)
        ON UPDATE cascade
        ON DELETE cascade
)
```

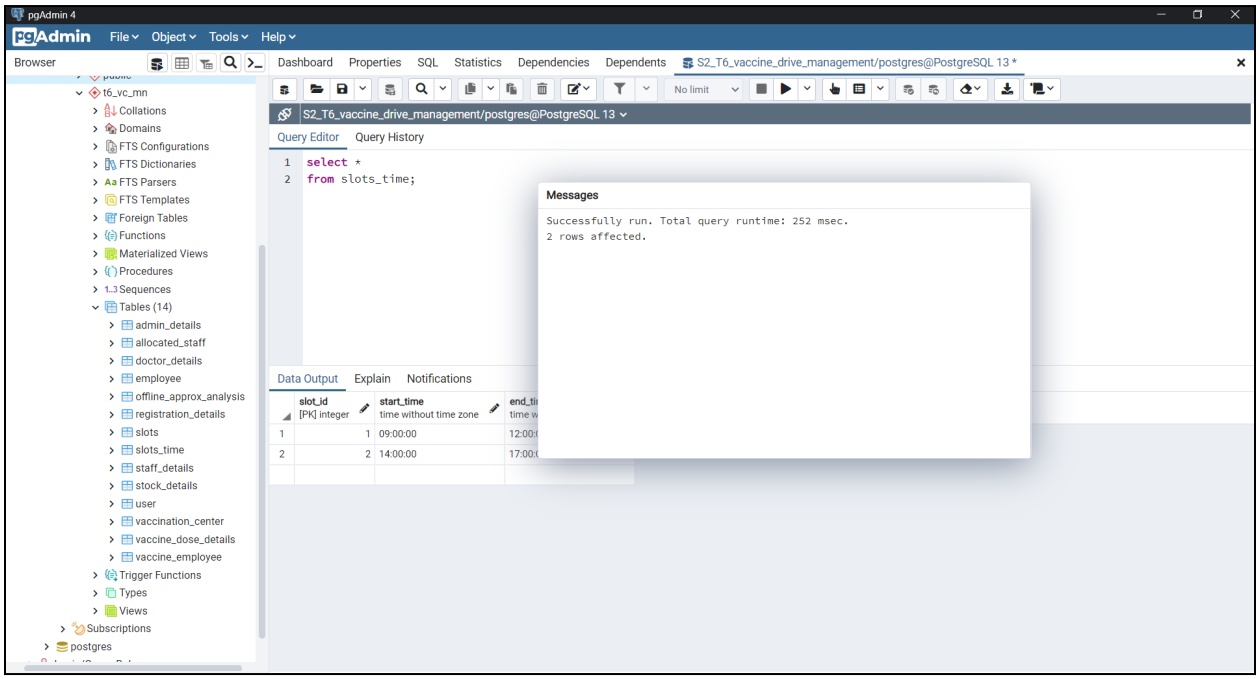
Insert Statements and screenshots of loaded data

copy user
from 'D:\dbms\user.csv'
csv header

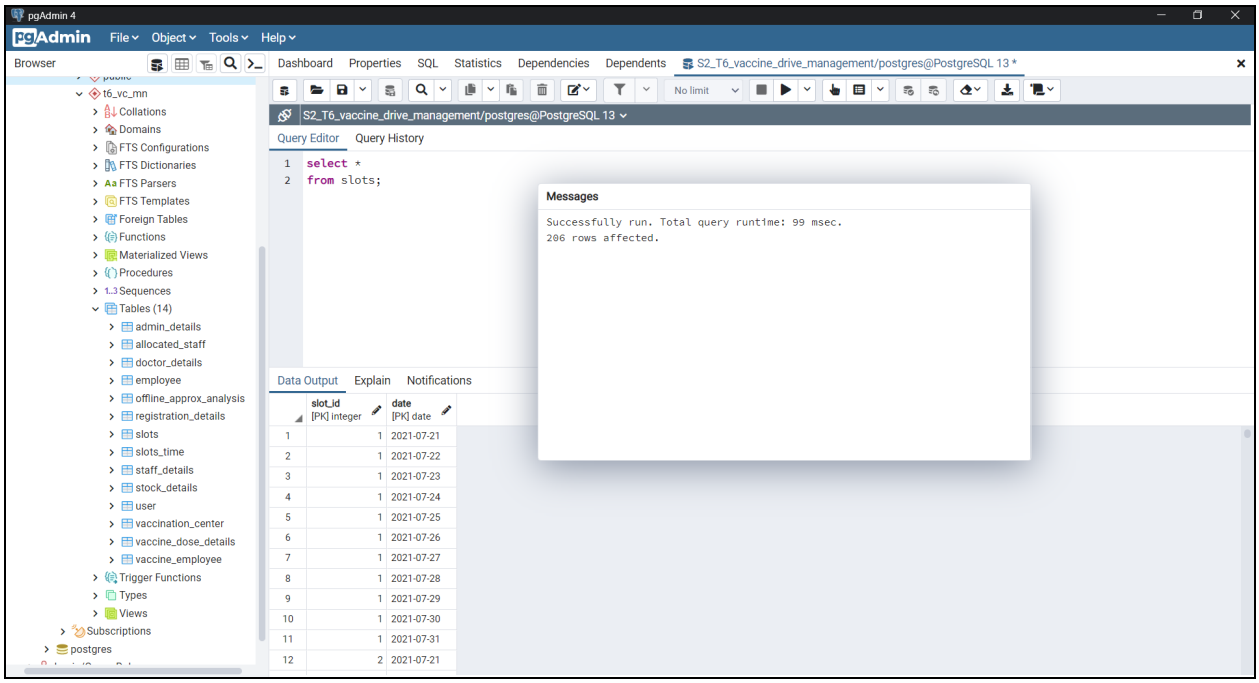


u_id [PK] bigint	u_name character (20)	u_age numeric (4,2)				
1	Xavier	2				
2	Louis	3				
3	Beatrisa	2.00	F	surat	4731955181	Olivette
4	Chickie	2.25	F	rajkot	2578779323	Cheri
5	Drew	5.00	M	ahmedabad	3084043136	Gaelan
6	Golda	9.50	F	vadodara	8732589357	Isabeau
7	Sharleen	4.00	F	surat	5618672074	Margette
8	Lauree	2.50	F	ahmedabad	3396307512	Dulcie
9	Allyn	13.00	M	rajkot	2227476868	Noach
10	Arther	2.00	M	rajkot	5785394151	Lennie
11	Harman	5.00	M	junagadh	8884472999	Ibrahim
12	Katuscha	6.00	F	junagadh	7707395446	Allsun

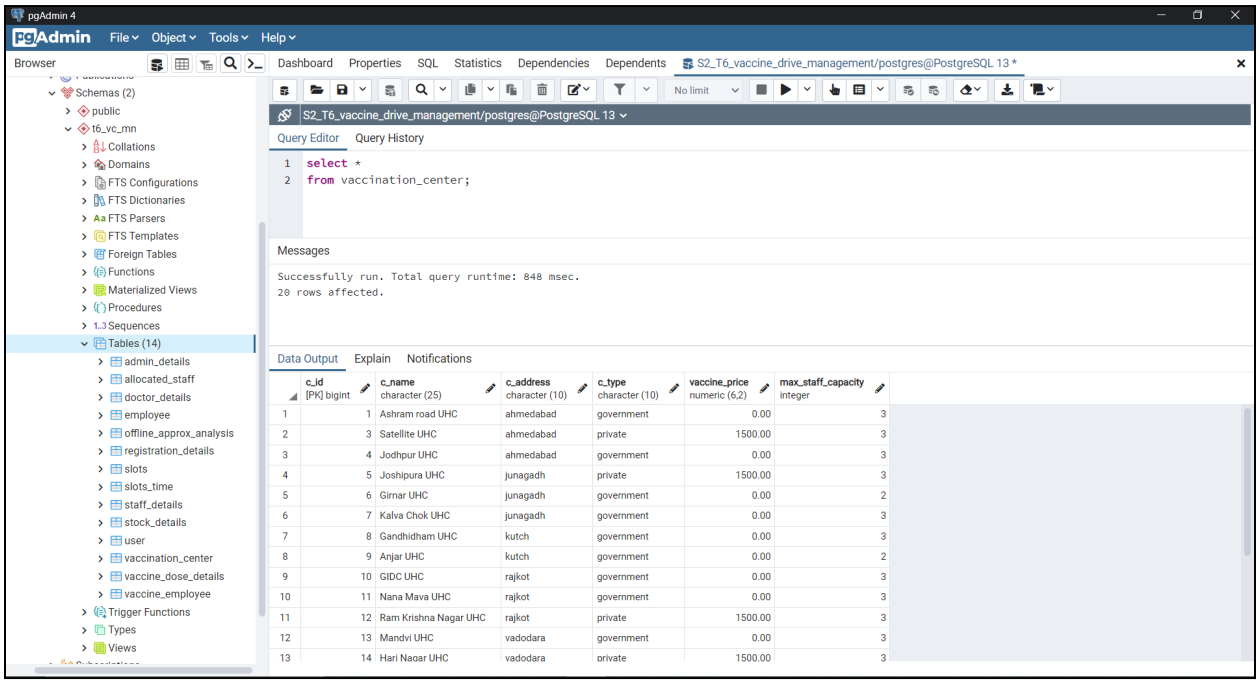
copy slots_time
from 'D:\dbms\slots_time.csv'
csv header



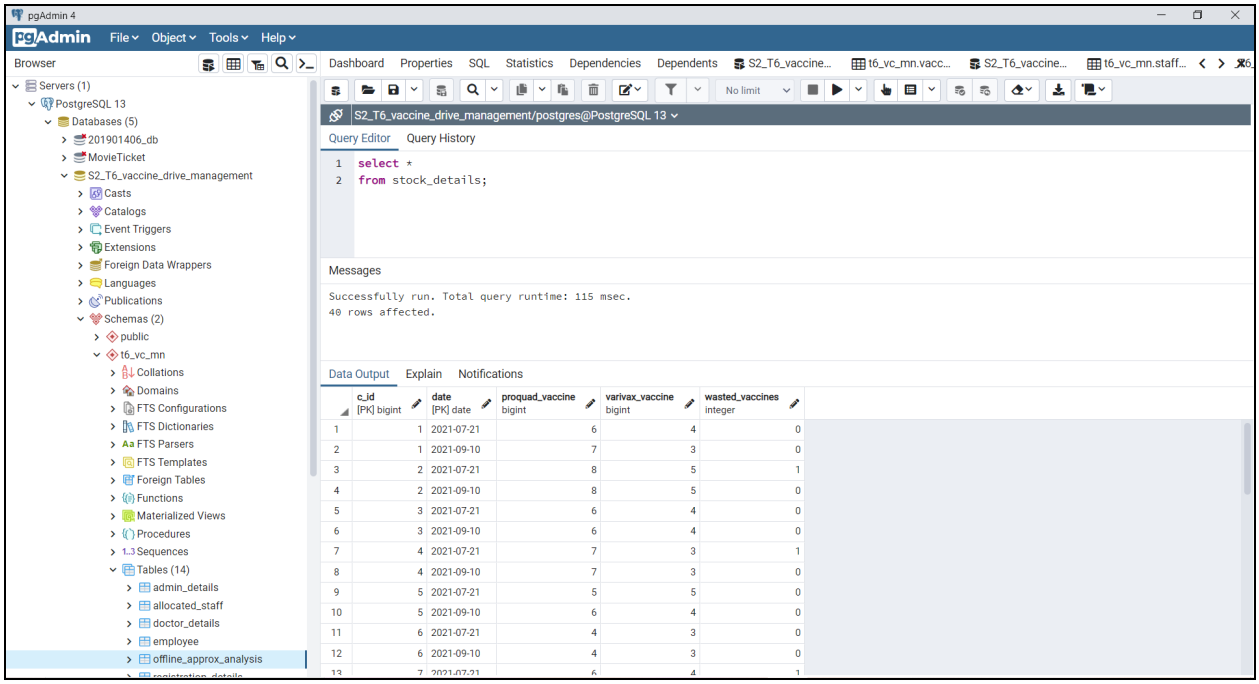
copy slots
from 'D:\dbms\slots.csv'
csv header



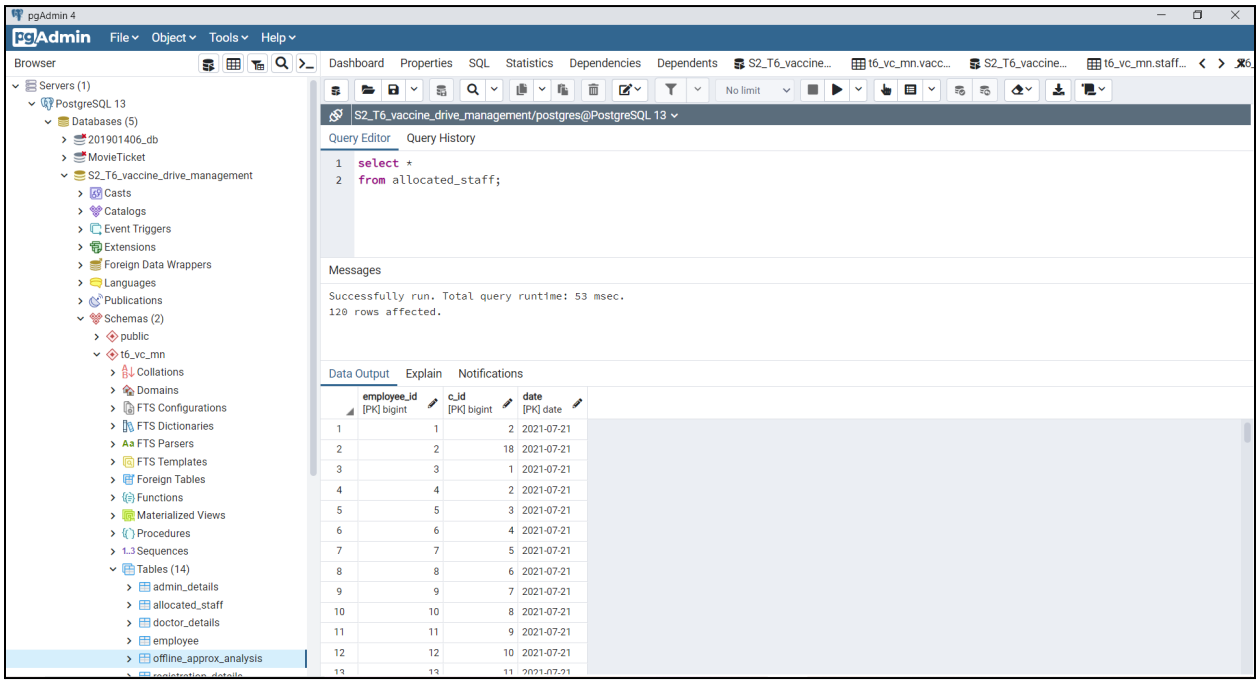
copy vaccination_center
from 'D:\dbms\vaccination_center.csv'
csv header



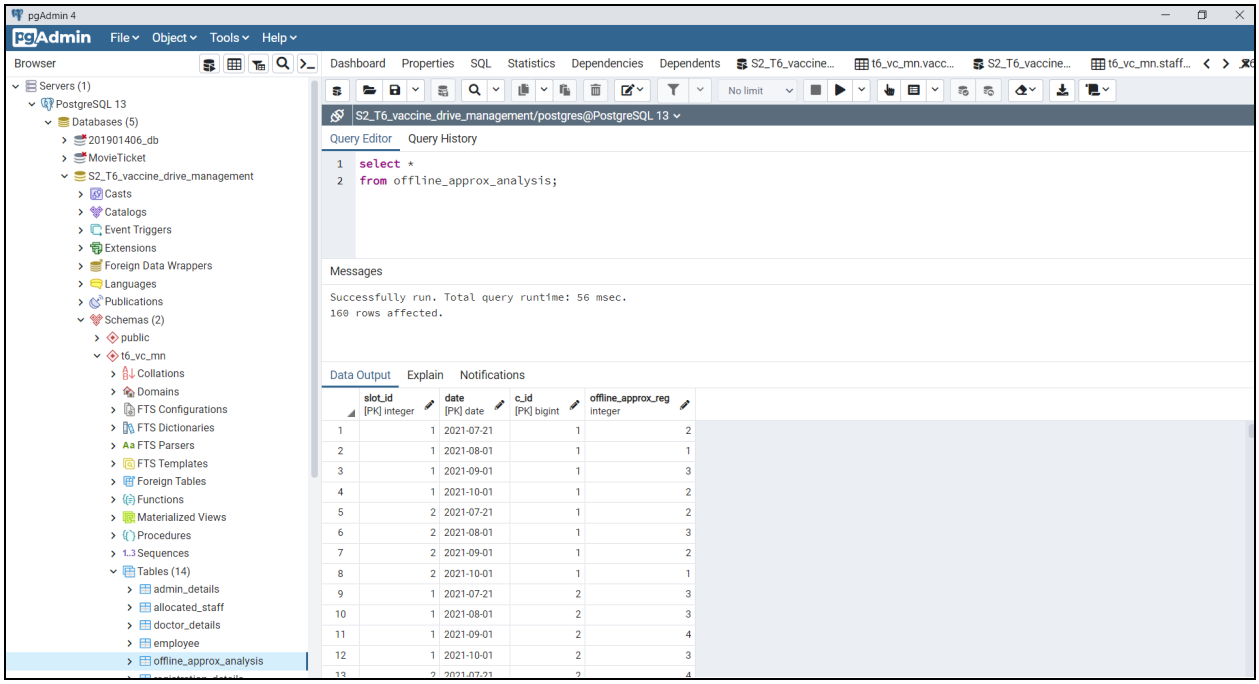
copy stock_details
from 'D:\dbms\stock_details.csv'
csv header



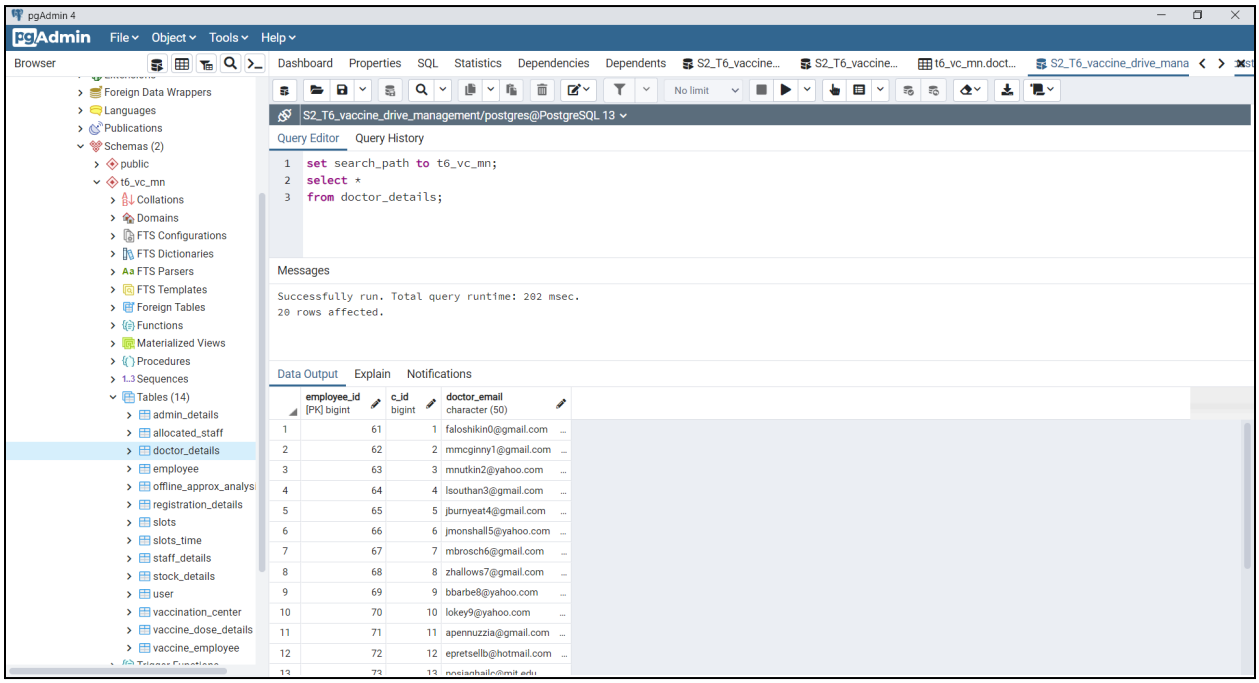
copy allocated_staff
from 'D:\dbms\allocated_staff.csv'
csv header



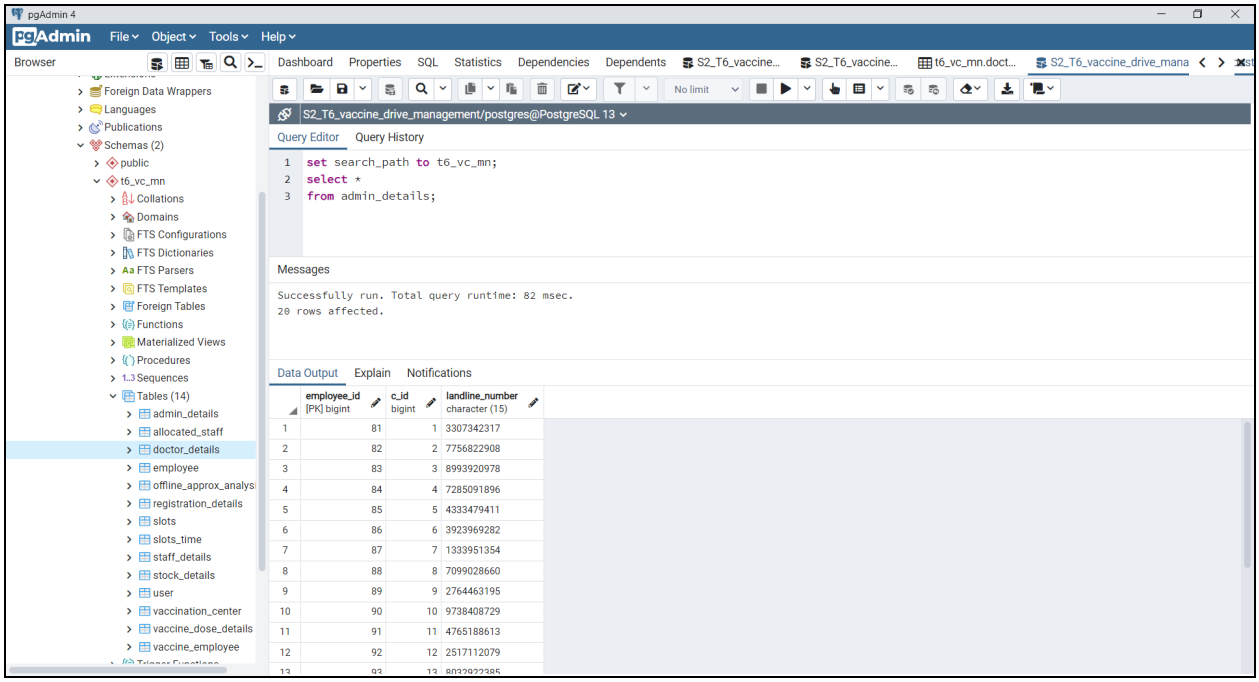
copy offline_approx_analysis
from 'D:\dbms\offline_approx_analysis.csv'
csv header



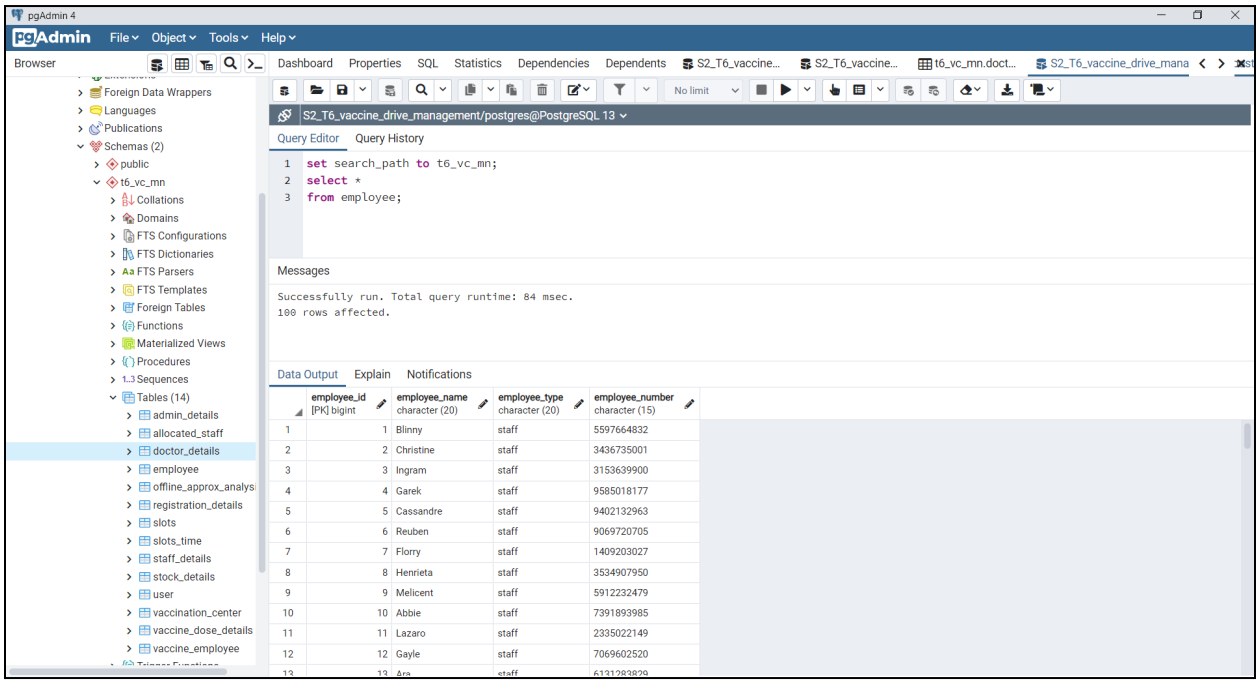
copy doctor_details
from 'D:\dbms\doctor_details.csv'
csv header



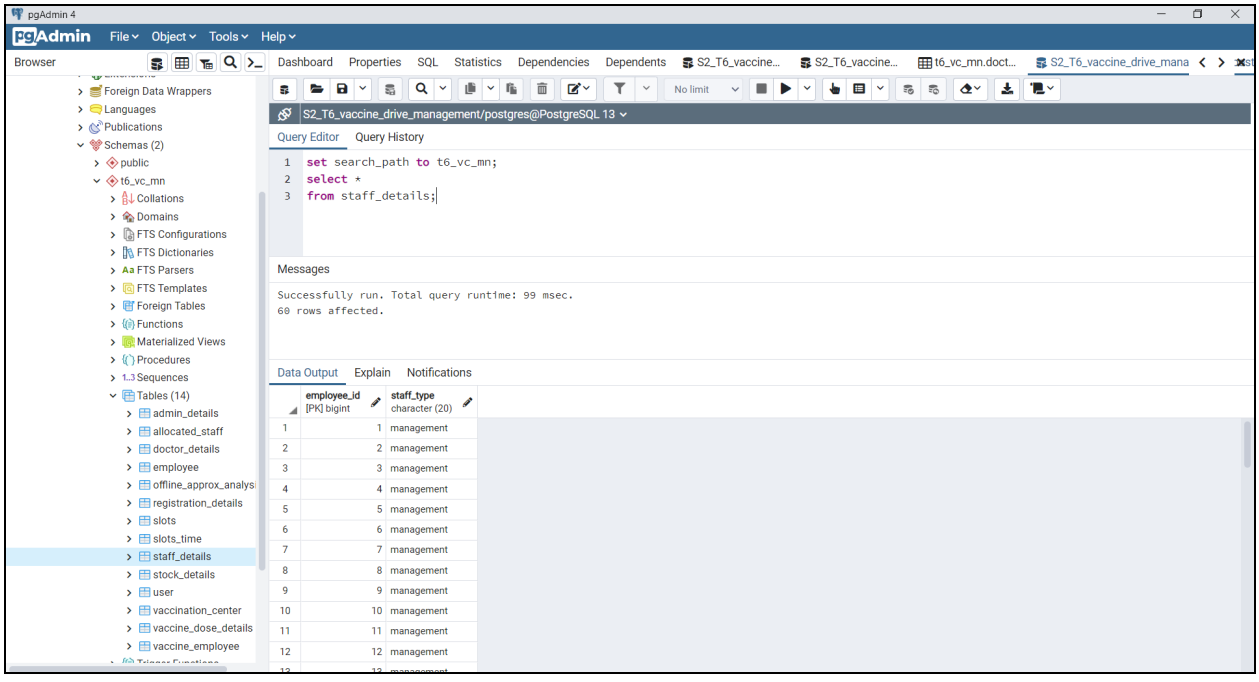
copy admin_details
from 'D:\dbms\admin_details.csv'
csv header



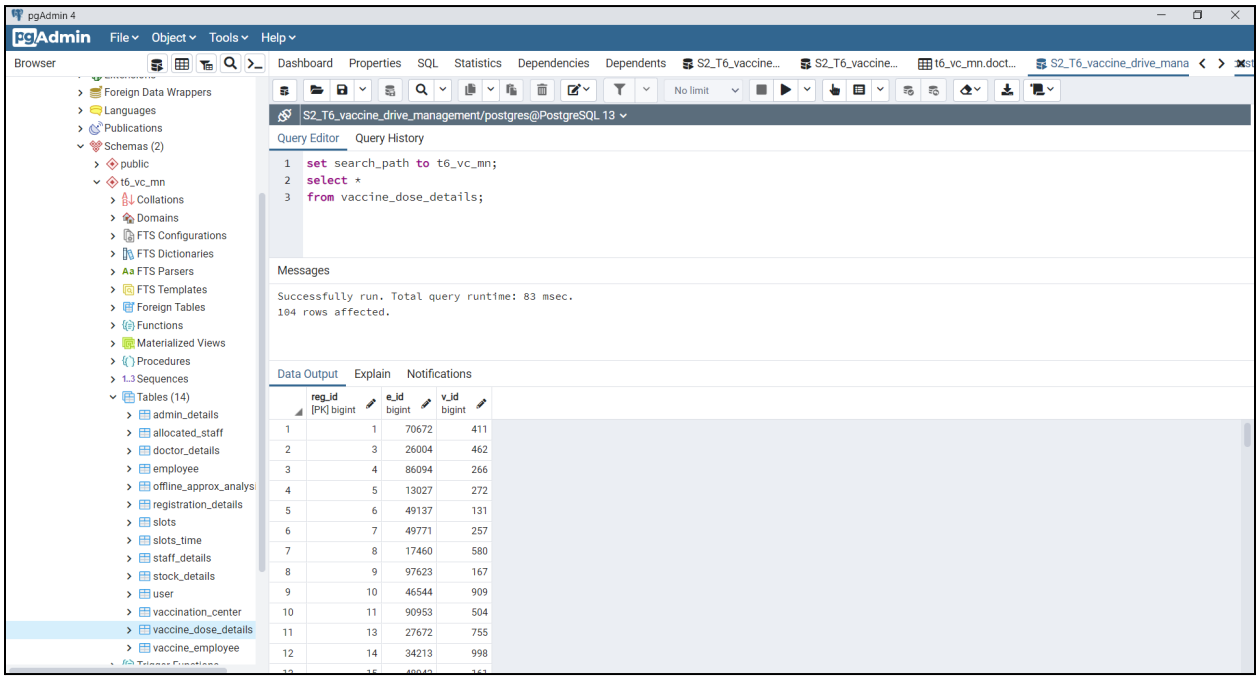
copy employee
from 'D:\dbms\employee.csv'
csv header



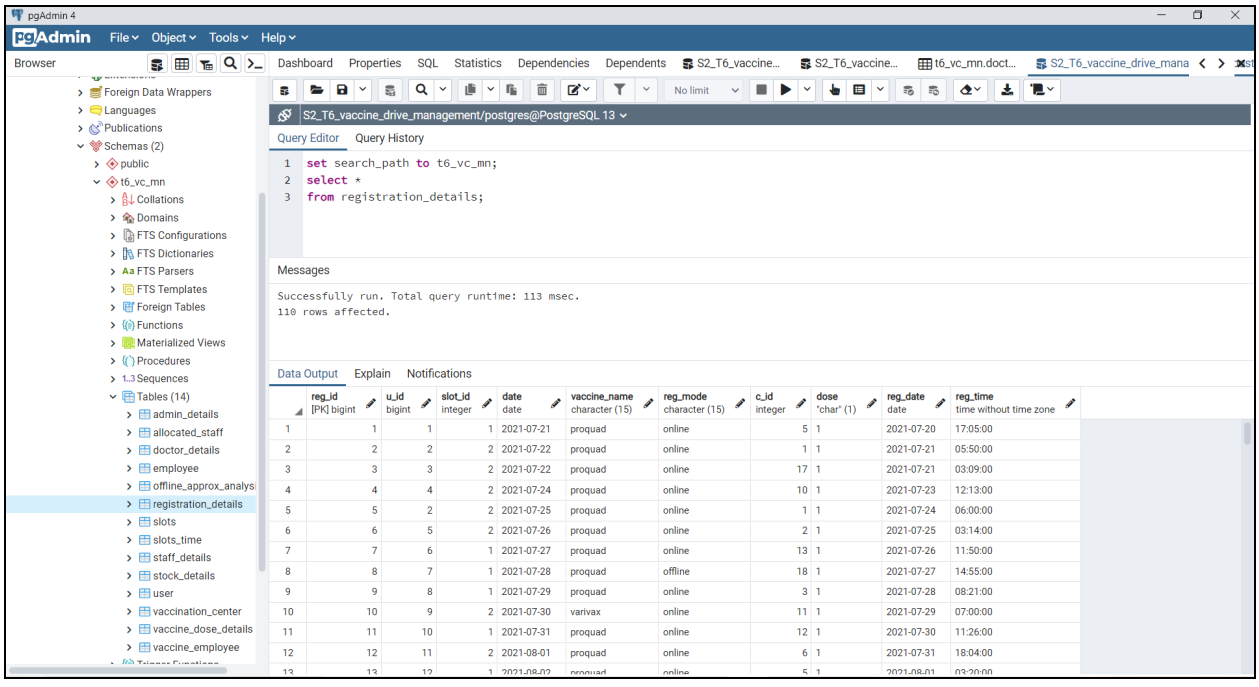
copy staff_details
from 'D:\dbms\staff_details.csv'
csv header



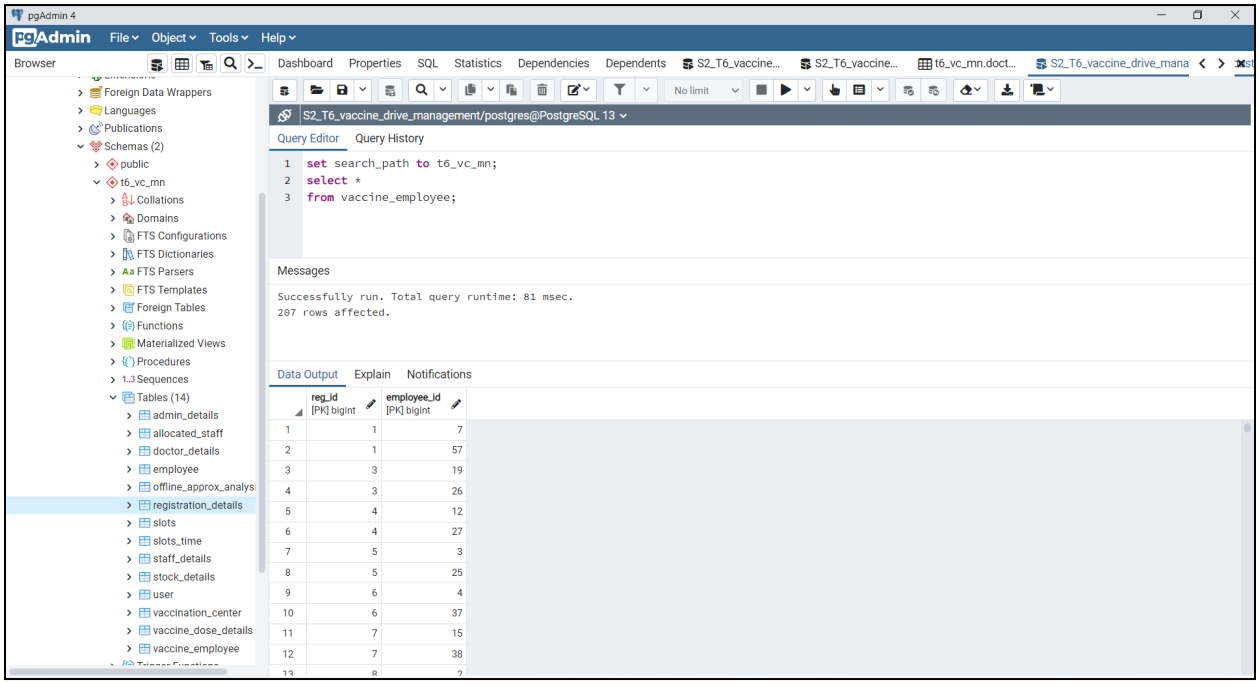
copy vaccine_dose_details
from 'D:\dbms\vaccine_dose_details.csv'
csv header



copy registration_details
from 'D:\dbms\registration_details.csv'
csv header



```
copy  vaccine_employee
from 'D:\dbms\vaccine_employee.csv'
csv header
```



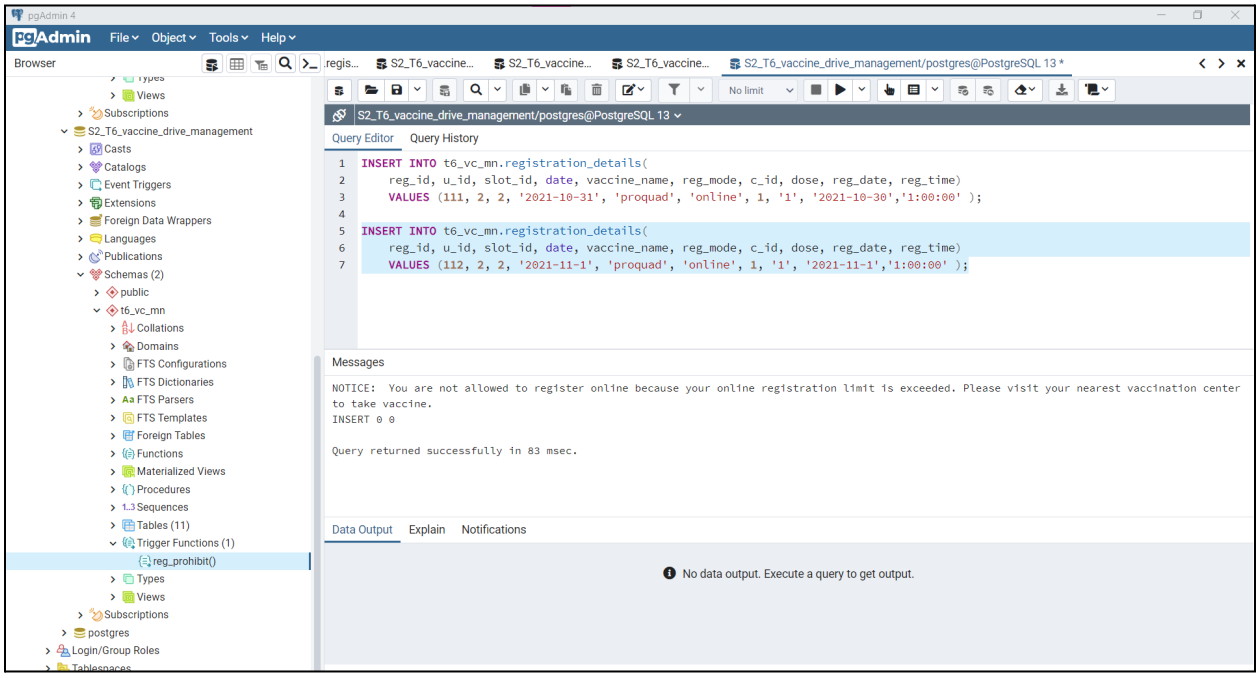
Trigger Functions

1) Prohibition of online registration if a user tries to register more than 3 times and not reach to take the vaccine.

Code:

```
declare
reg_count bigint;

begin

select count(u_id) into reg_count from t6_vc_mn."registration_details"
where "u_id"=New."u_id" and "dose"=New."dose";

if (reg_count=3 and New."reg_mode"='online') then
Raise notice 'You are not allowed to register online because your online registration limit is exceeded. Please visit your nearest vaccination center to take vaccine.';
return null;
else
return new;
end if;

end
```

Output:

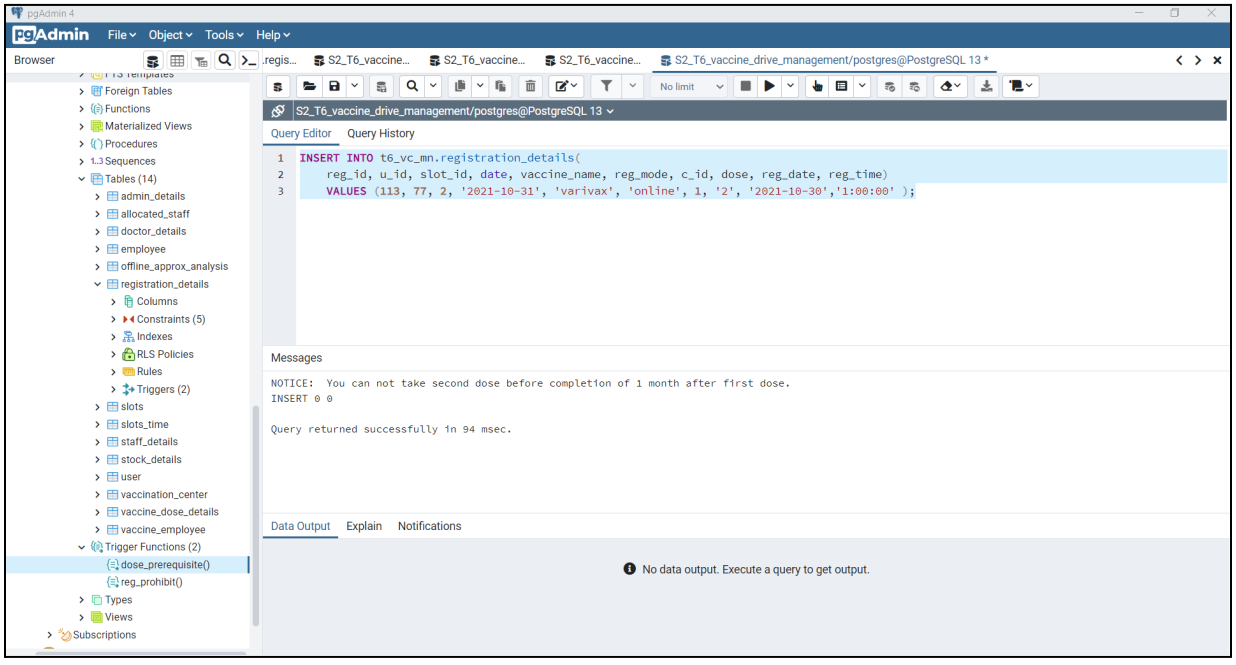


2) Prohibition of registration if a user tries to register for the second dose before completion of one month after the first dose.

Code:

```
declare
d date;

begin

if (new."dose"='2') then
select "date" into d
from t6_vc_mn."registration_details" inner join t6_vc_mn."vaccine_dose_details"
on t6_vc_mn."registration_details"."reg_id" = t6_vc_mn."vaccine_dose_details"."reg_id"
where "u_id"=New."u_id" and "dose"='1';

if (new."date"-d < 30) then
Raise notice 'You can not take second dose before completion of 1 month after first dose.';
return null;
end if;

return new;
else
return new;
end if;

end
```

Output:

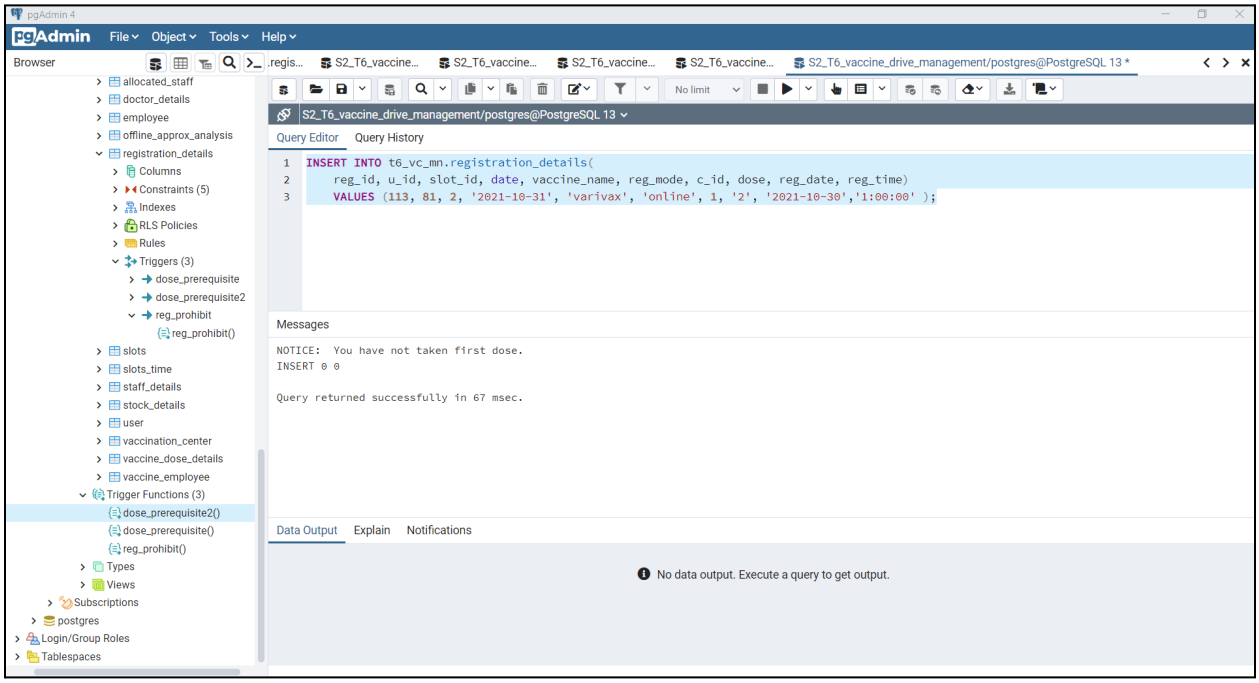


3) Prohibit users from registering for the second dose without taking the first dose.

Code:

```
declare
c int;

begin

if (new."dose"='2') then
select count(t6_vc_mn."vaccine_dose_details"."reg_id") into c
from t6_vc_mn."registration_details" inner join t6_vc_mn."vaccine_dose_details"
on t6_vc_mn."registration_details"."reg_id" = t6_vc_mn."vaccine_dose_details"."reg_id"
where "u_id"=New."u_id" and "dose"='1';

if (c=0) then
Raise notice 'You have not taken first dose.';
return null;
else
return new;
end if;

else
return new;

end if;
end
```

Output:

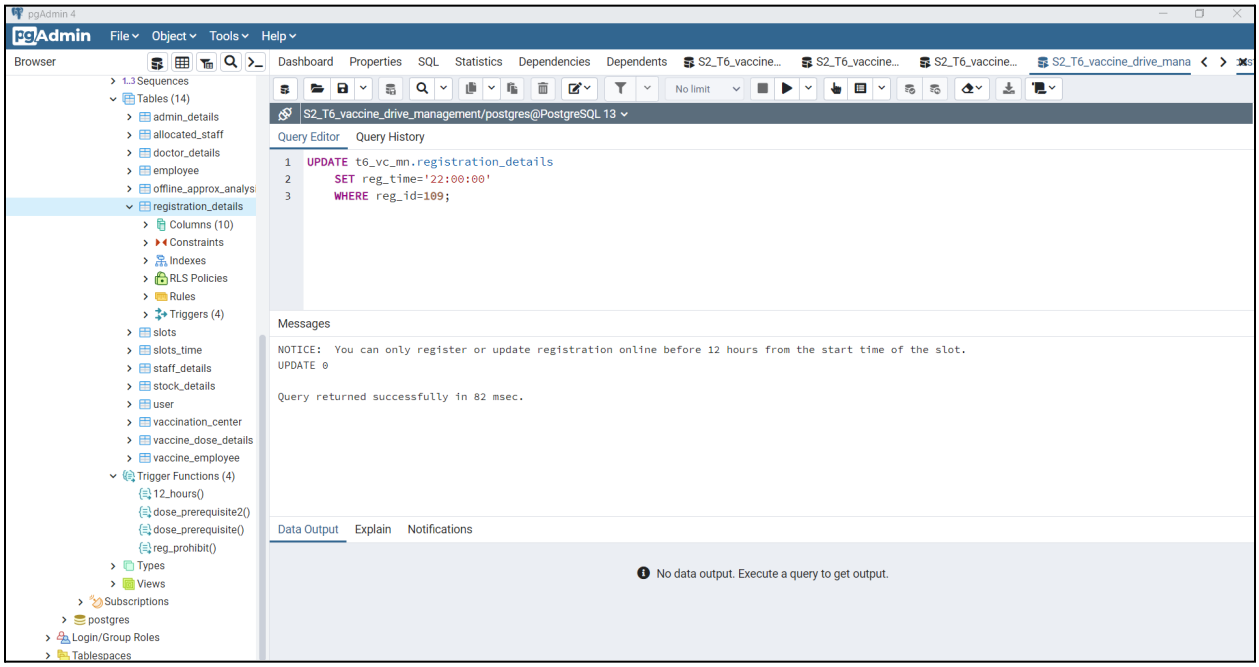


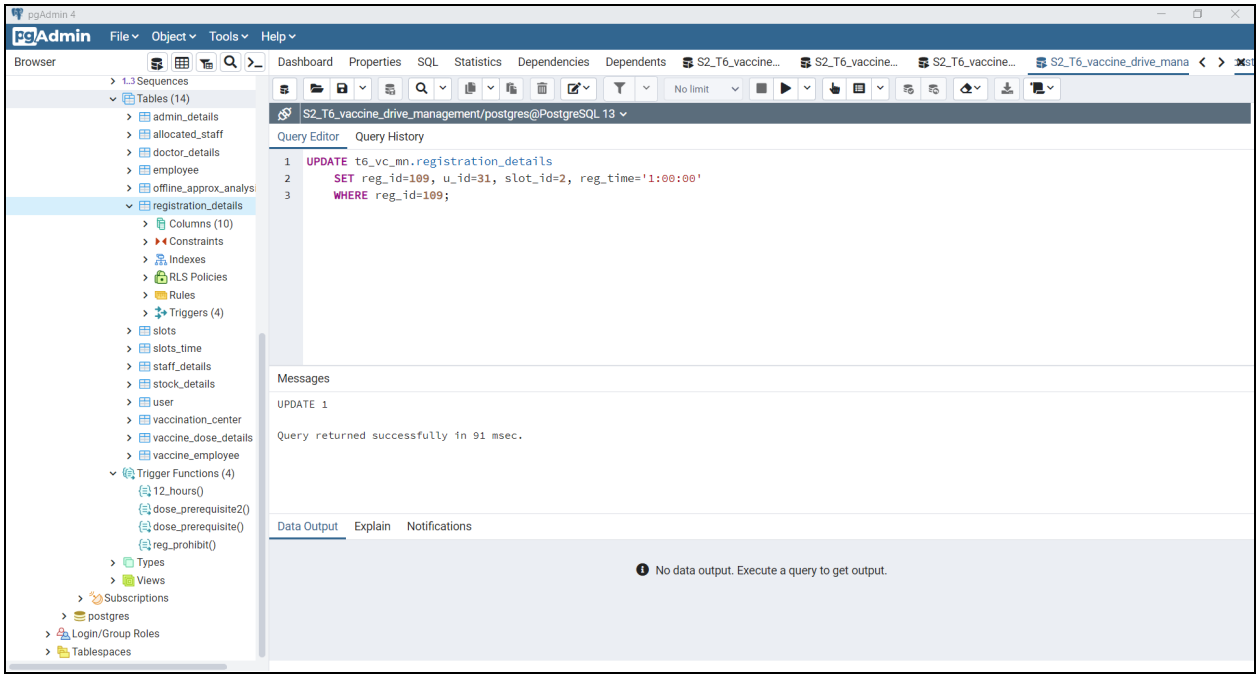
4) Provide a rescheduling facility to users before 12 hours of registered slot.

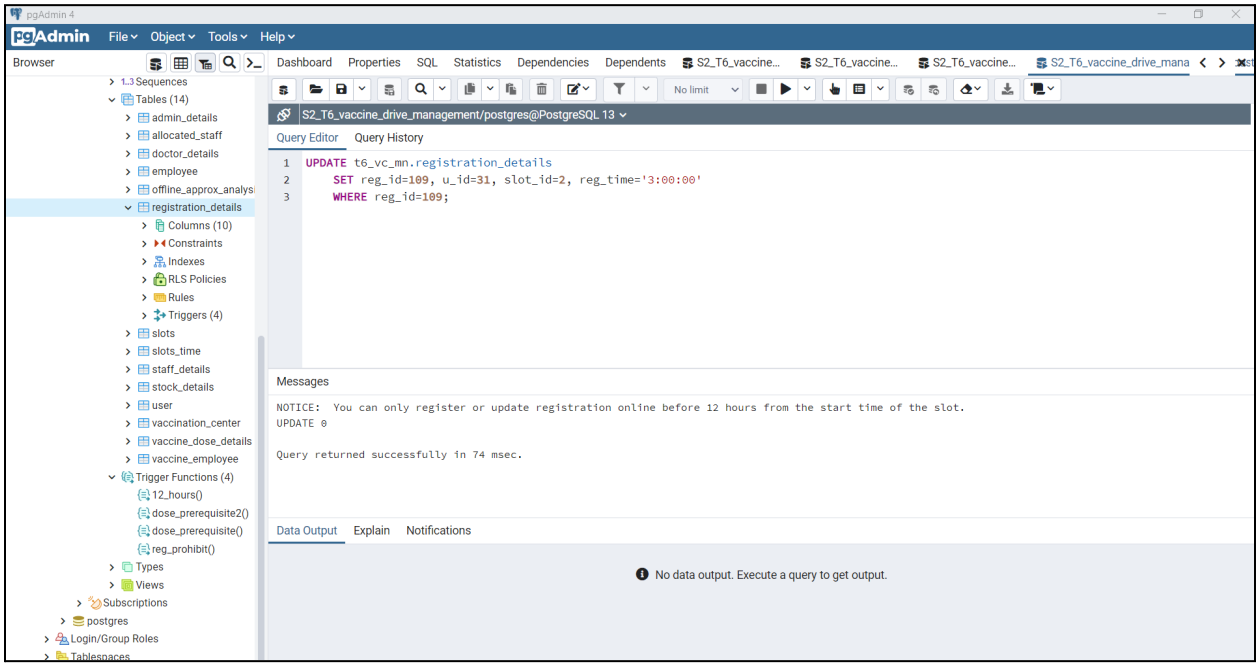
Code:

```
begin
if (new."reg_mode"='online') then
        if(new."date" - new."reg_date"=1 and new."slot_id"=1 and new."reg_time">'21:00:00') then
                Raise notice 'You can only register or update registration online before 12 hours from the start
time of the slot.';
                return null;
        end if;
        if(new."date"-new."reg_date"=0 and new."slot_id"=1) then
                Raise notice 'You can only register or update registration online before 12 hours from the start
time of the slot.';
                return null;
        end if;
        if(new."date"-new."reg_date"=0 and new."slot_id"=2 and new."reg_time">'2:00:00') then
                Raise notice 'You can only register or update registration online before 12 hours from the start
time of the slot.';
           return null;
        end if;
        return new;
else
return new;
end if;
end
```

Output:




pgAdmin 4
File Object Tools Help
Browser
Dashboard Properties SQL Statistics Dependencies Dependents
S2_T6_vaccine_drive_management/postgres@PostgreSQL 13
Query Editor Query History
1 UPDATE t6_vc_mn.registration_details
2 SET reg_id=109, u_id=31, slot_id=2, reg_time='1:00:00'
3 WHERE reg_id=109;
Messages
UPDATE 1
Query returned successfully in 91 msec.
Data Output Explain Notifications
No data output. Execute a query to get output.

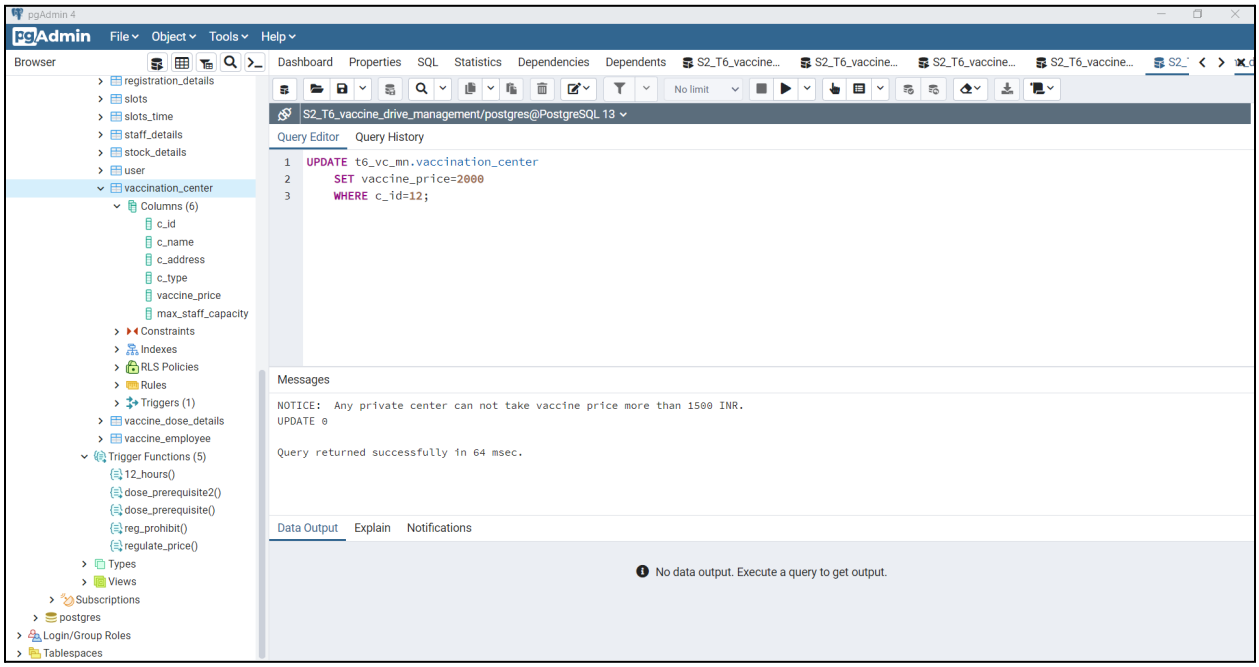

pgAdmin 4
File Object Tools Help
Browser
Dashboard Properties SQL Statistics Dependencies Dependents
S2_T6_vaccine_drive_management/postgres@PostgreSQL 13
Query Editor Query History
1 UPDATE t6_vc_mn.registration_details
2 SET reg_id=109, u_id=31, slot_id=2, reg_time='3:00:00'
3 WHERE reg_id=109;
Messages
NOTICE: You can only register or update registration online before 12 hours from the start time of the slot.
UPDATE 0
Query returned successfully in 74 msec.
Data Output Explain Notifications
No data output. Execute a query to get output.

5) Regulate prices of vaccines at private vaccination centers.

Code:

```
begin

if (new."c_type"='private' and new."vaccine_price">1500) then
Raise notice 'Any private center can not take vaccine price more than 1500 INR.';
return null;
elseif ((new."c_type"='government' or new."c_type"='gov-D2D') and new."vaccine_price">0) then
Raise notice 'Any government center can not take vaccine price.';
return null;
end if;

return new;

end
```

Output:

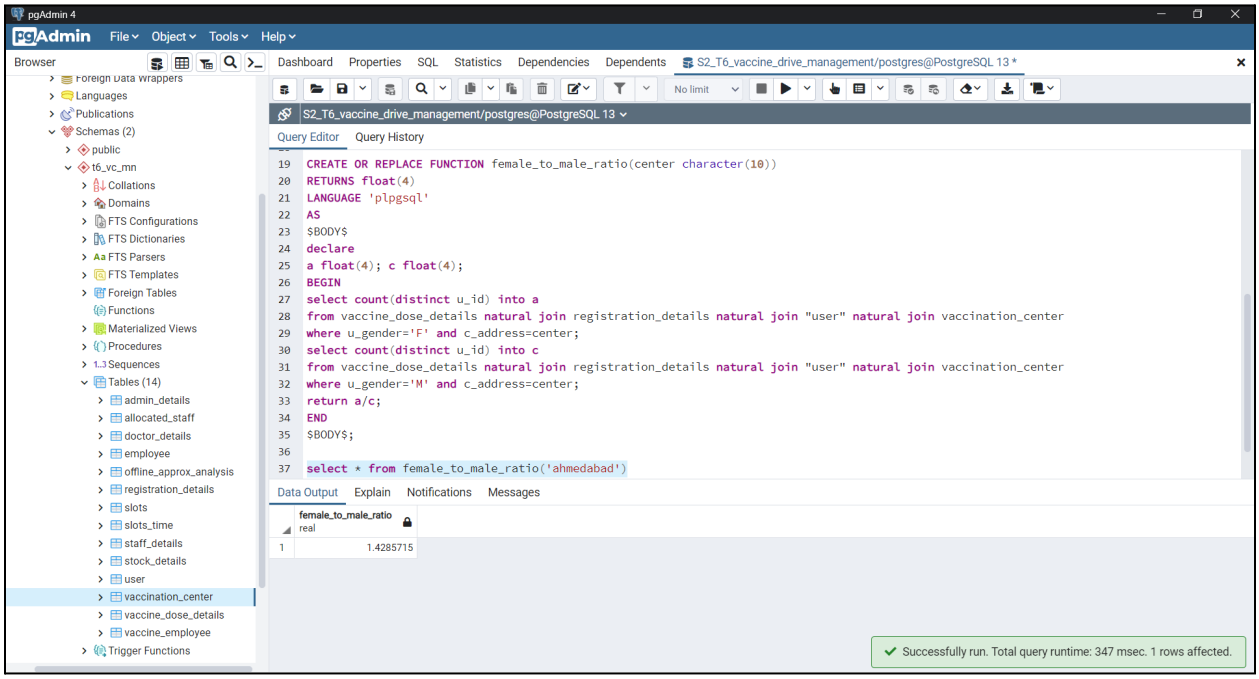


Functions:

1. Find female to male ratio who have taken at least the first dose of vaccine in a given city.

```
CREATE OR REPLACE FUNCTION female_to_male_ratio(center character(10))
RETURNS float(4)
LANGUAGE 'plpgsql'
AS
$BODY$
declare
a float(4); c float(4);
BEGIN
select count(distinct u_id) into a
from vaccine_dose_details natural join registration_details natural join "user" natural join vaccination_center
where u_gender='F' and c_address=center;
select count(distinct u_id) into c
from vaccine_dose_details natural join registration_details natural join "user" natural join vaccination_center
where u_gender='M' and c_address=center;
return a/c;
END
$BODY$;

select * from female_to_male_ratio('ahmedabad')
```

Output:



2. Find dynamic online registrations available for given c_id, slot_id and date.

Views:

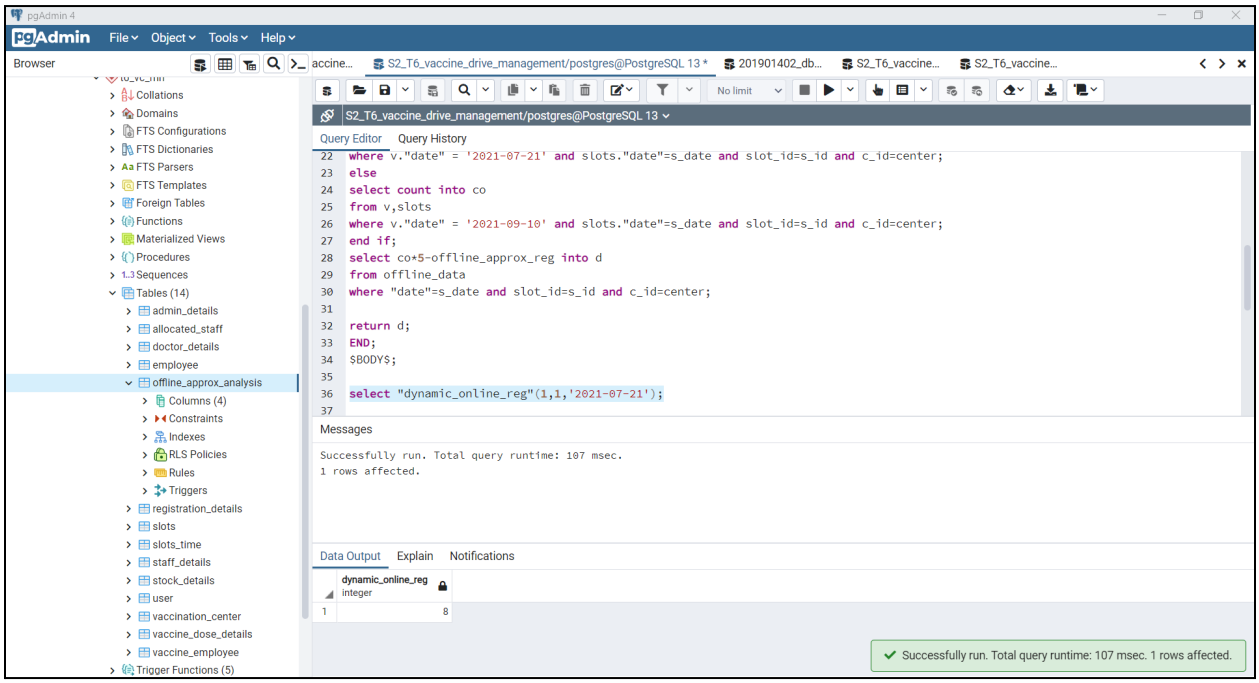
```
create view v as
select c_id,date,count(employee_id)
from allocated_staff natural join staff_details
where staff_type='health-care'
group by c_id,date;

create view offline_data as
select c_id,slots."slot_id",slots."date",offline_approx_reg
from offline_approx_analysis inner join slots
on offline_approx_analysis."slot_id"=slots."slot_id"
where (slots."date"<'2021-08-01' and offline_approx_analysis."date"='2021-07-21')
or ((slots."date" between '2021-08-01' and '2021-08-31') and offline_approx_analysis."date"='2021-08-01')
or ((slots."date" between '2021-09-01' and '2021-09-30')  and offline_approx_analysis."date"='2021-09-01')
or ((slots."date" between '2021-10-01' and '2021-10-31')  and offline_approx_analysis."date"='2021-10-01');
```

Function:

```
CREATE OR REPLACE function "dynamic_online_reg"(center bigint, s_id integer, s_date date)
RETURNS integer
LANGUAGE 'plpgsql'
AS $BODY$

declare
co integer;

declare
d integer;
BEGIN

if(s_date<'2021-09-10') then
select count into co
from v,slots
where v."date" = '2021-07-21' and slots."date"=s_date and slot_id=s_id and c_id=center;
else
select count into co
from v,slots
where v."date" = '2021-09-10' and slots."date"=s_date and slot_id=s_id and c_id=center;
end if;
select co*5-offline_approx_reg into d
from offline_data
where "date"=s_date and slot_id=s_id and c_id=center;

return d;
END;
$BODY$;
```

select "dynamic_online_reg"(1,1,'2021-07-21');

Output:

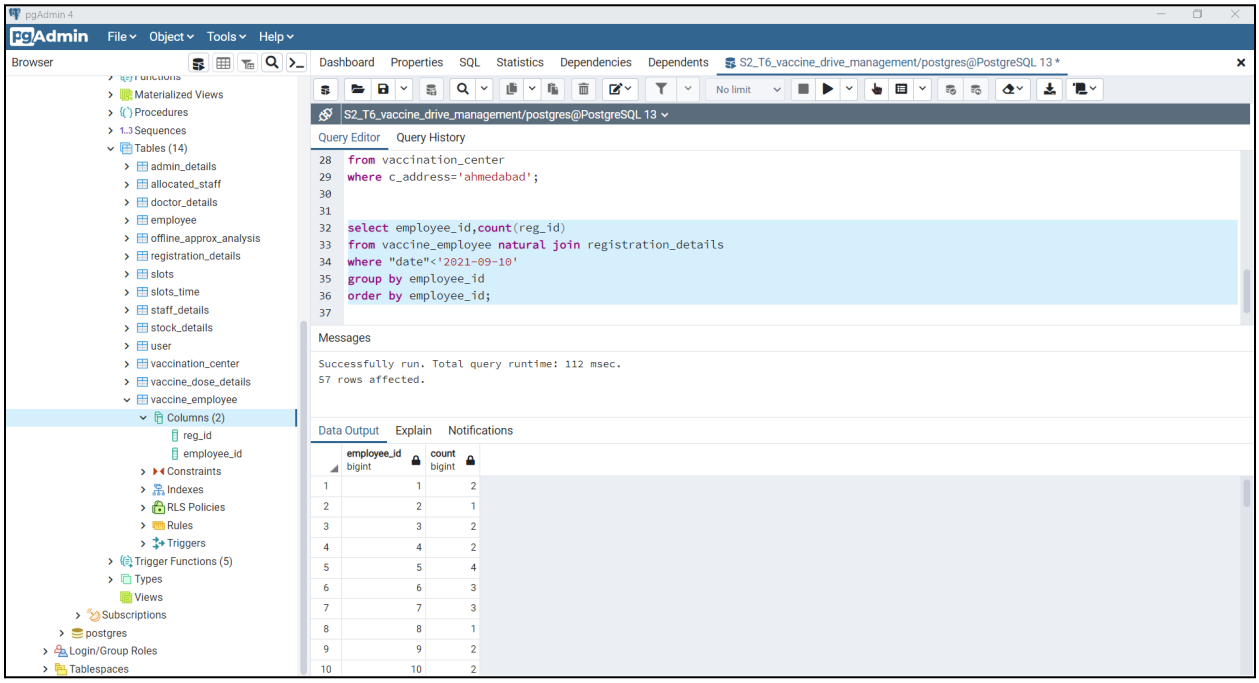


SQL queries:

1. Determine staff utilization for both the staff allocations.

For first allocation:

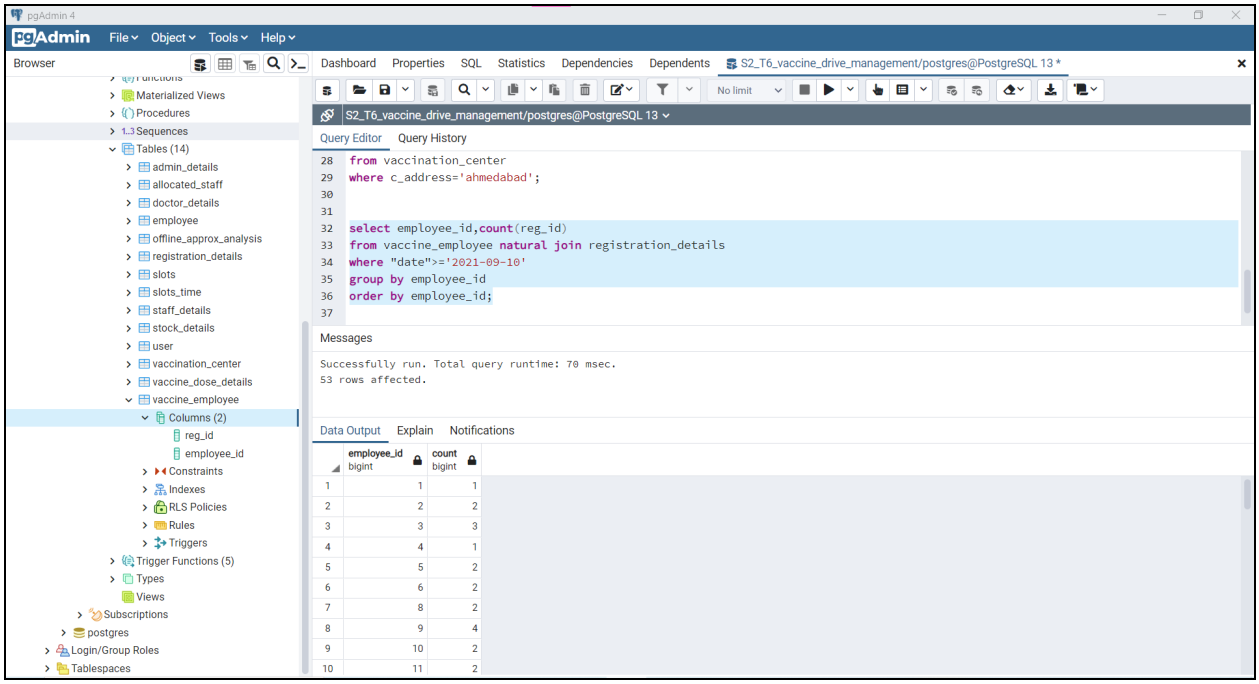
```
select employee_id,count(reg_id)
from vaccine_employee natural join registration_details
where "date"<'2021-09-10'
group by employee_id
order by employee_id;
```



No. of tuples = 57.

For second allocation:

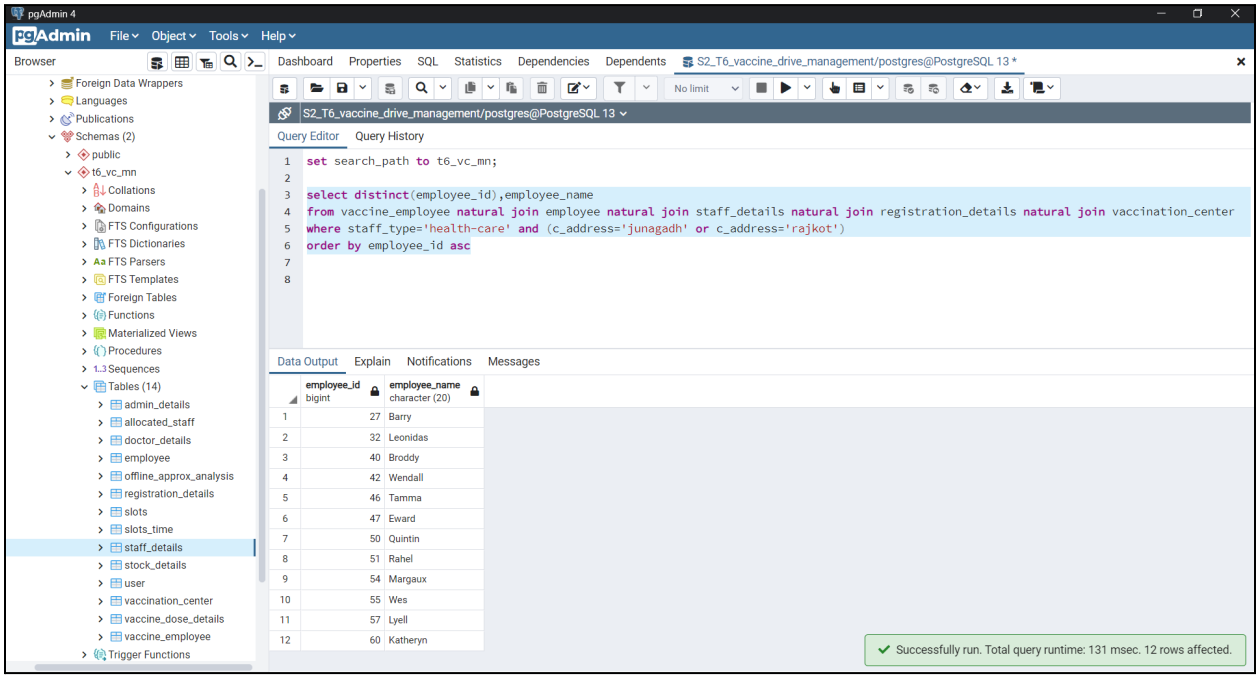
```
select employee_id,count(reg_id)
from vaccine_employee natural join registration_details
where "date">='2021-09-10'
group by employee_id
order by employee_id;
```



No. of tuples = 53.

2. List out ids and names of health-care employees who work in city junagadh or rajkot.

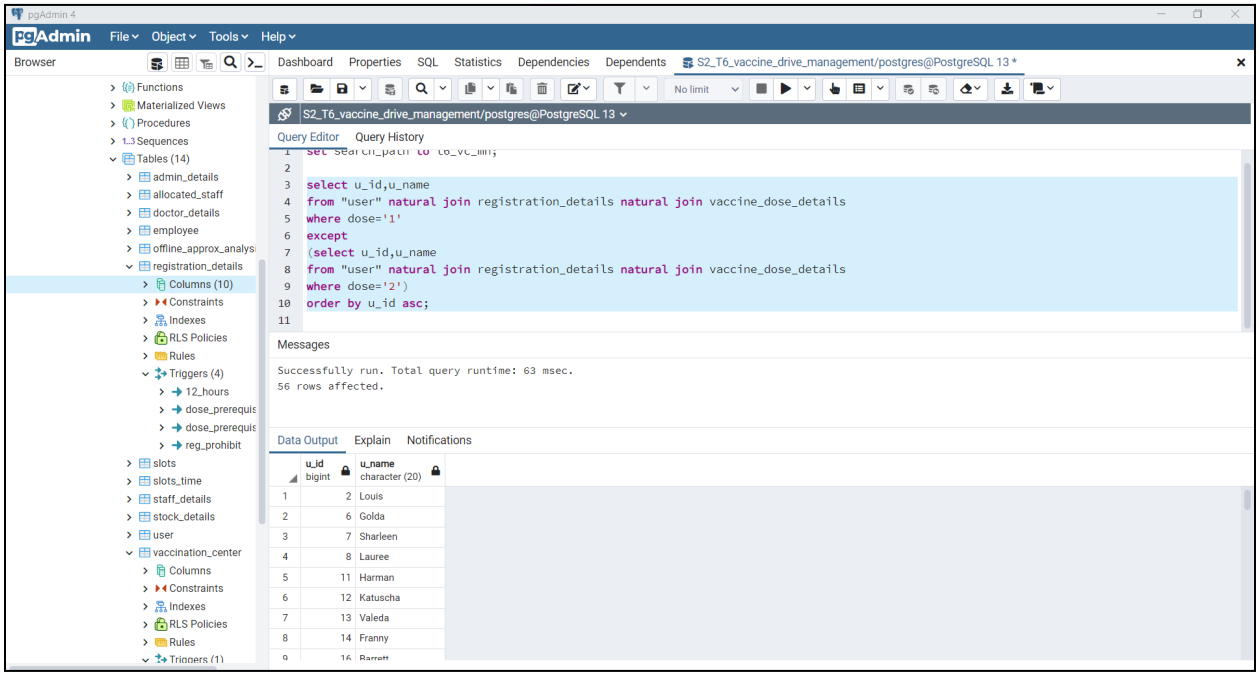
select distinct(employee_id),employee_name
from vaccine_employee natural join employee natural join staff_details natural join registration_details natural join vaccination_center
where staff_type='health-care' and (c_address='junagadh' or c_address='rajkot')
order by employee_id asc



No of tuples : 12

3. List out all the users who are partially vaccinated.

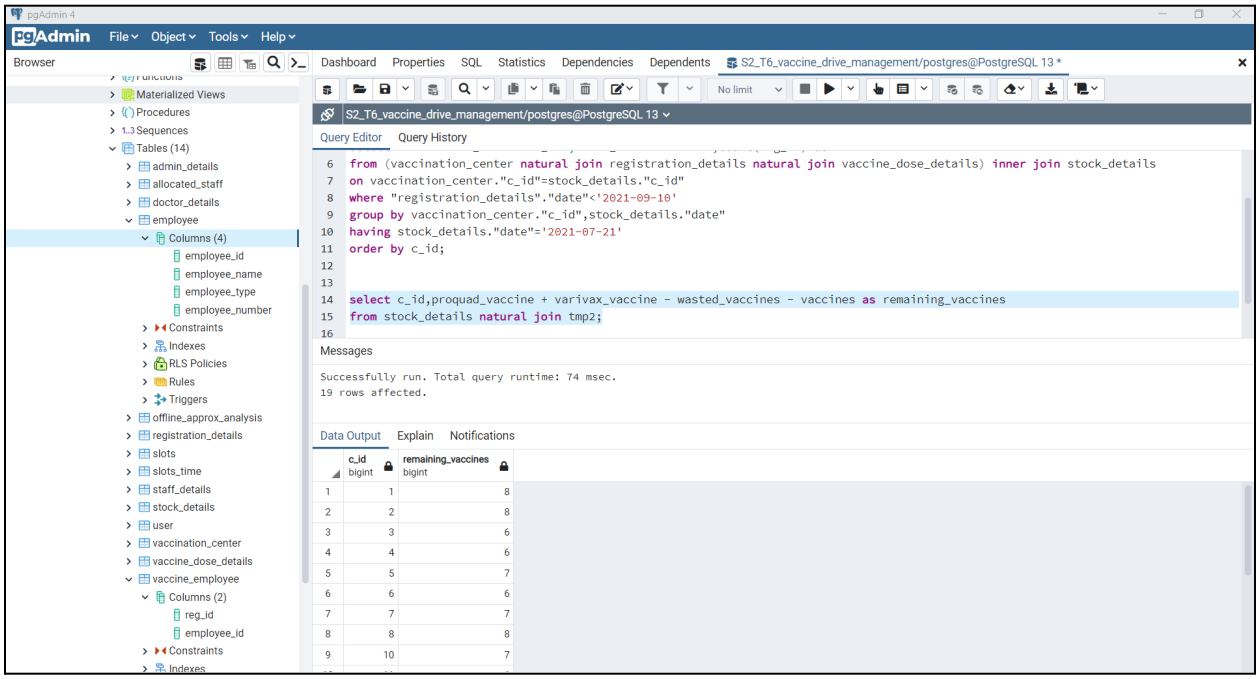
```
select u_id,u_name
from "user" natural join registration_details natural join vaccine_dose_details
where dose='1'
except
(select u_id,u_name
from "user" natural join registration_details natural join vaccine_dose_details
where dose='2')
order by u_id asc;
```



No. of tuples = 56.

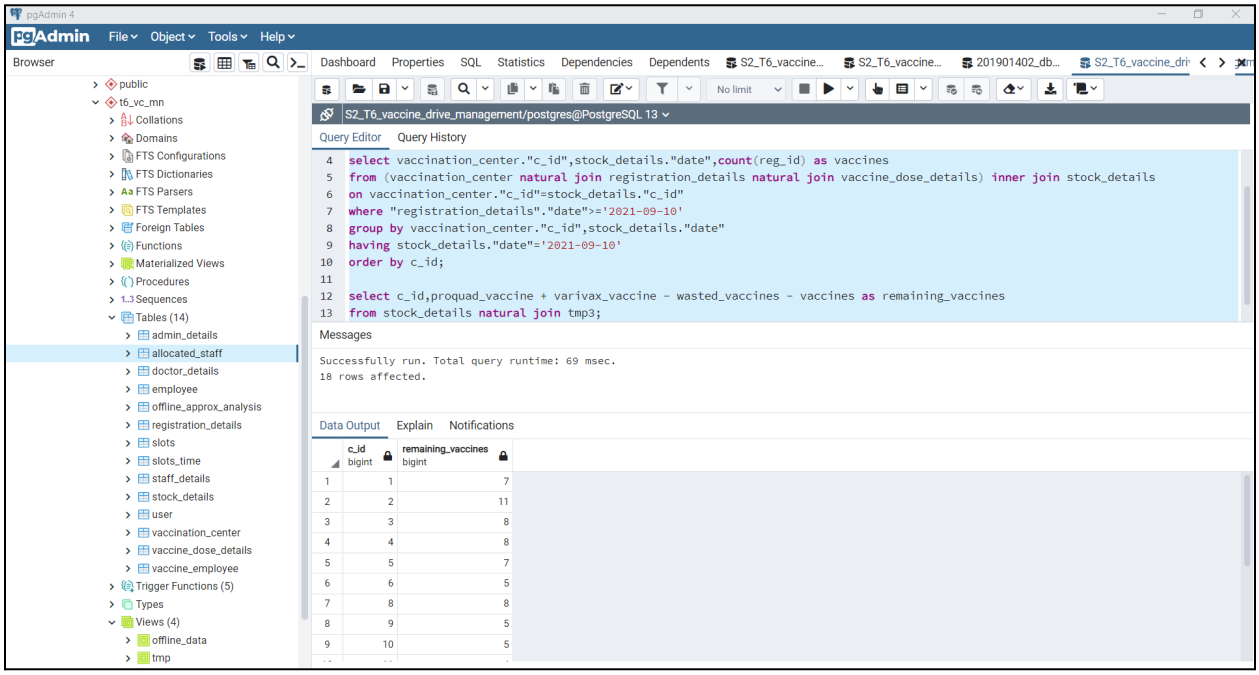
4. Find the no. of remaining vaccines at every center for both the stocks.

```
create view tmp2 as
select vaccination_center."c_id",stock_details."date",count(reg_id) as vaccines
from (vaccination_center natural join registration_details natural join vaccine_dose_details) inner join stock_details
on vaccination_center."c_id"=stock_details."c_id"
where "registration_details"."date"<'2021-09-10'
group by vaccination_center."c_id",stock_details."date"
having stock_details."date"='2021-07-21'
order by c_id;

select c_id,proquad_vaccine + varivax_vaccine - wasted_vaccines - vaccines as remaining_vaccines
from stock_details natural join tmp2;
```



No. of tuples = 19.

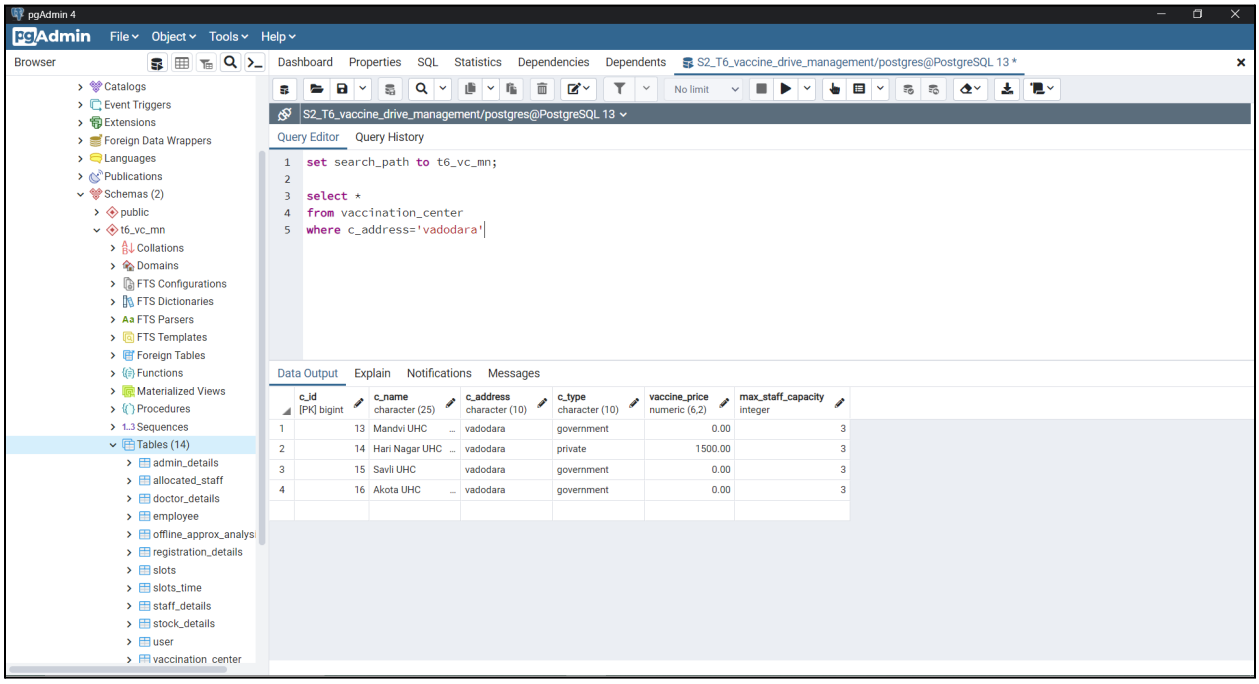
```
create view tmp3 as
select vaccination_center."c_id",stock_details."date",count(reg_id) as vaccines
from (vaccination_center natural join registration_details natural join vaccine_dose_details) inner join stock_details
on vaccination_center."c_id"=stock_details."c_id"
where "registration_details"."date">='2021-09-10'
group by vaccination_center."c_id",stock_details."date"
having stock_details."date"='2021-09-10'
order by c_id;

select c_id,proquad_vaccine + varivax_vaccine - wasted_vaccines - vaccines as remaining_vaccines
from stock_details natural join tmp3;
```



No. of tuples = 18.

5. Give details of the vaccination center that belongs to vadodara.

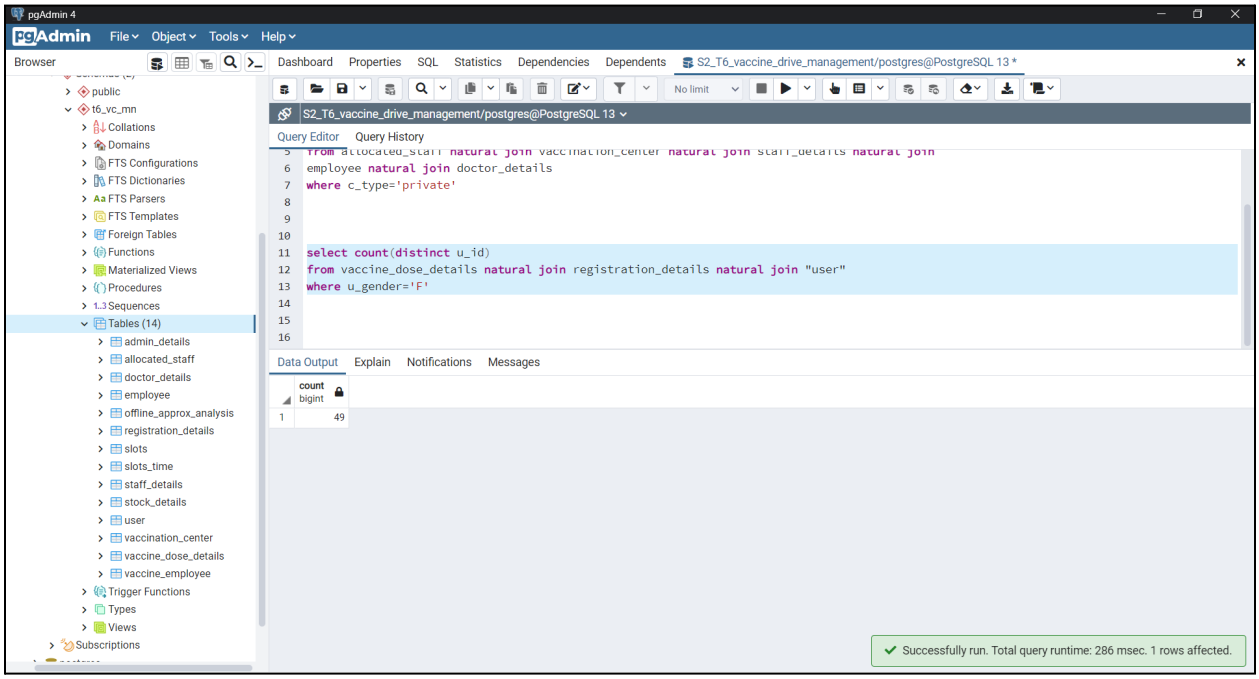
```
select *
from vaccination_center
where c_address='vadodara'
```



No of tuples : 4

6. Count female users who have taken at least one dose of vaccine.

```
select count(distinct u_id)
from vaccine_dose_details natural join registration_details natural join "user"
where u_gender='F'
```

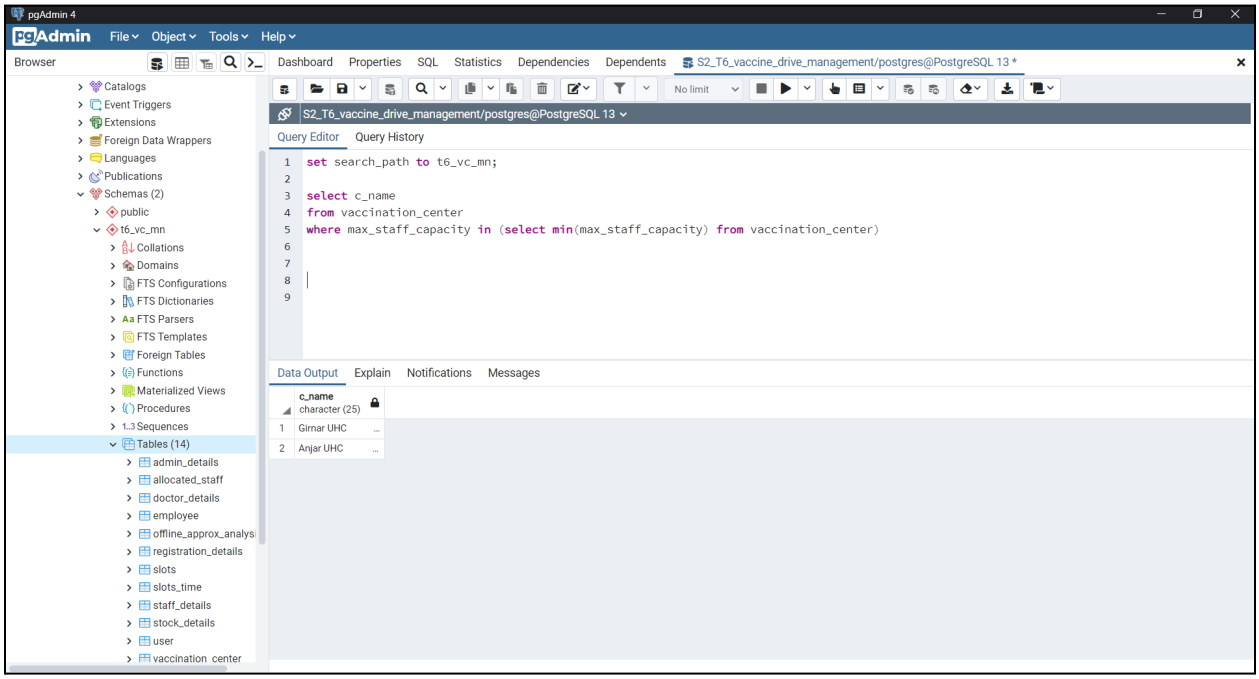


No of tuples : 1

Number of female users : 49

7. Give name of the vaccination center which has minimum staff capacity.

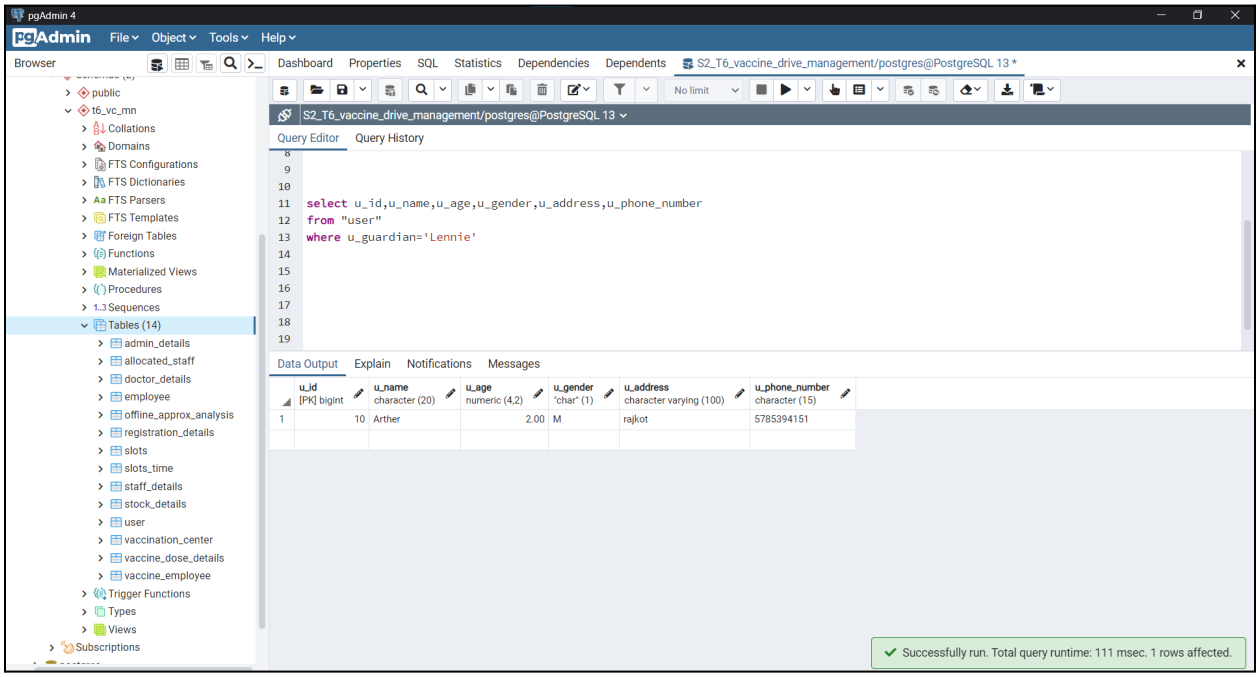
select c_name
from vaccination_center
where max_staff_capacity in (select min(max_staff_capacity) from vaccination_center)



No of tuples : 2

8. List user details whose guardian is Lennie.

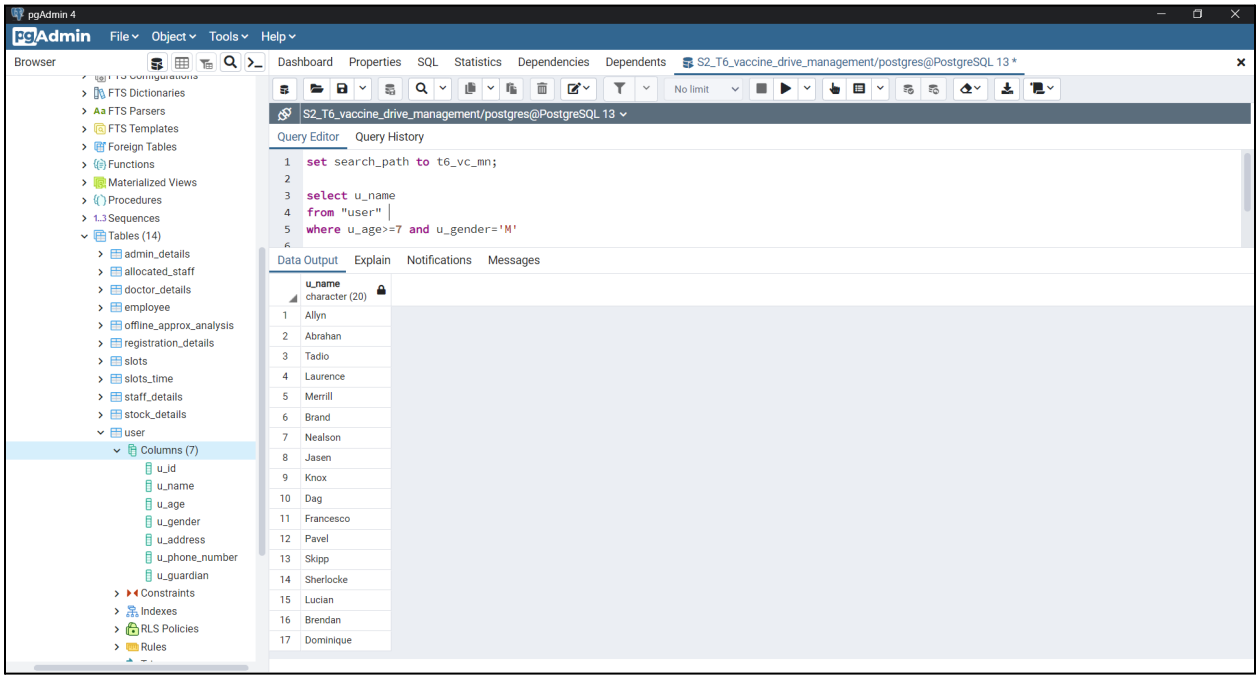
```
select u_id,u_name,u_age,u_gender,u_address,u_phone_number
from "user"
where u_guardian='Lennie'
```



No of tuples : 1

9. List the user names who are male and at least 7 years old.

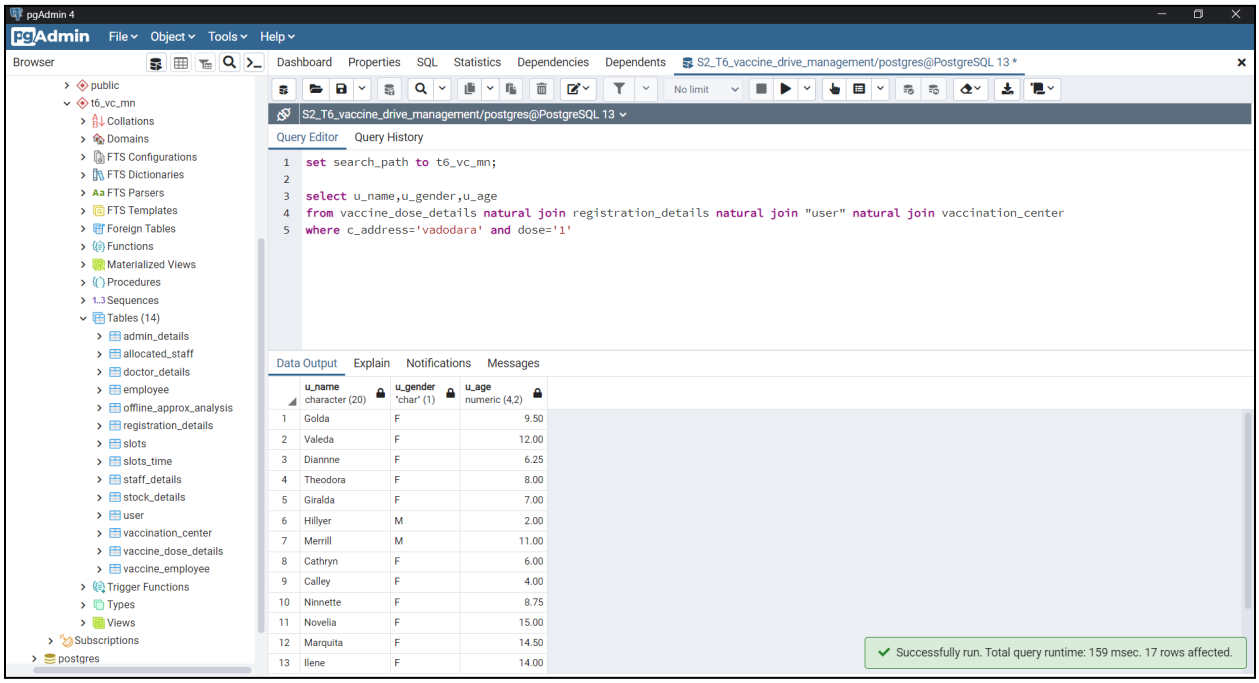
```
select u_name
from "user"
where u_age>=7 and u_gender='M'
```



No of tuples : 17

10. Give user details such as name, gender and age who has taken at least 1st dose and belongs to city vadodara.

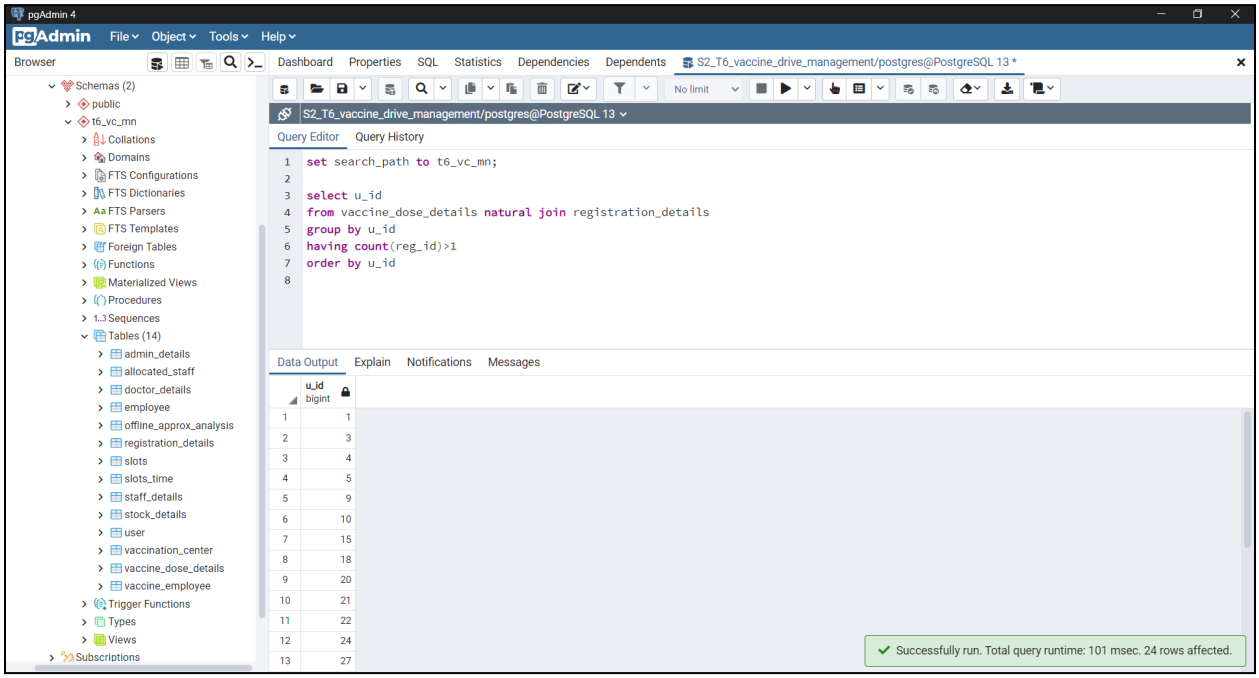
select u_name,u_gender,u_age
from vaccine_dose_details natural join registration_details natural join "user" natural join vaccination_center
where c_address='vadodara' and dose='1'



No of tuples : 17

11. Print all the user ids which have registered more than one time.

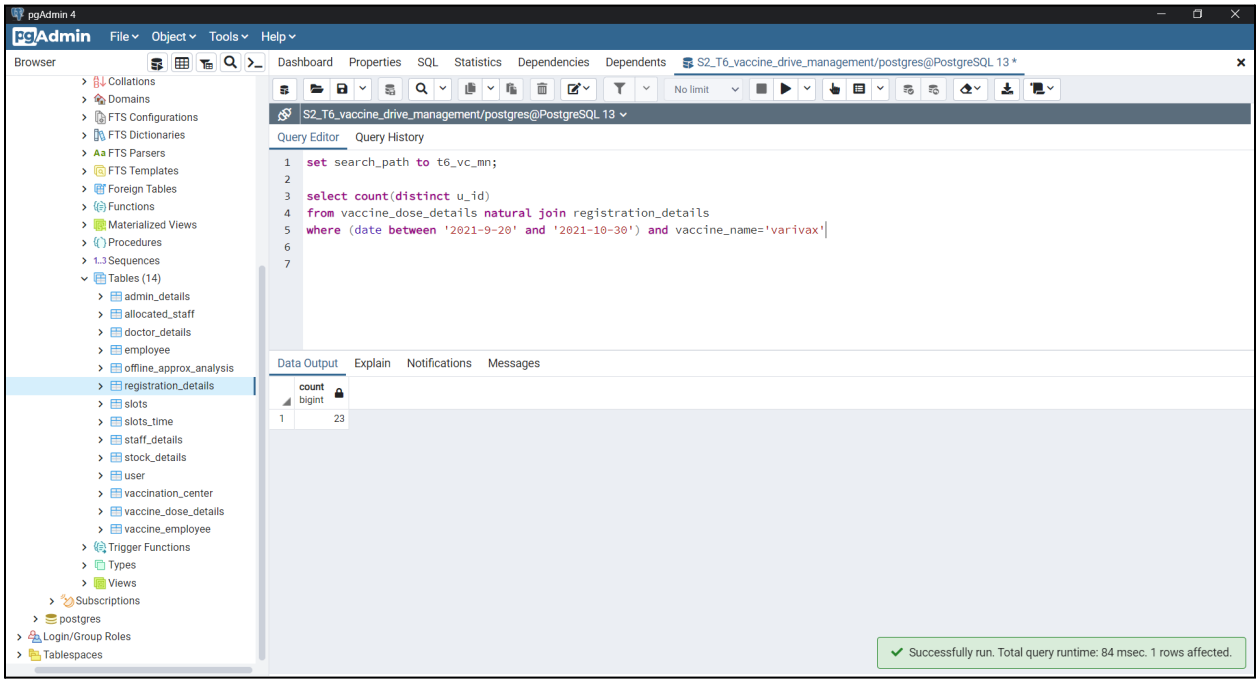
```
select u_id
from vaccine_dose_details natural join registration_details
group by u_id
having count(reg_id)>1
order by u_id
```



No of tuples : 24

12. Find the number of users who have taken varivax vaccine's at least one dose between 20 sep to 30 oct.

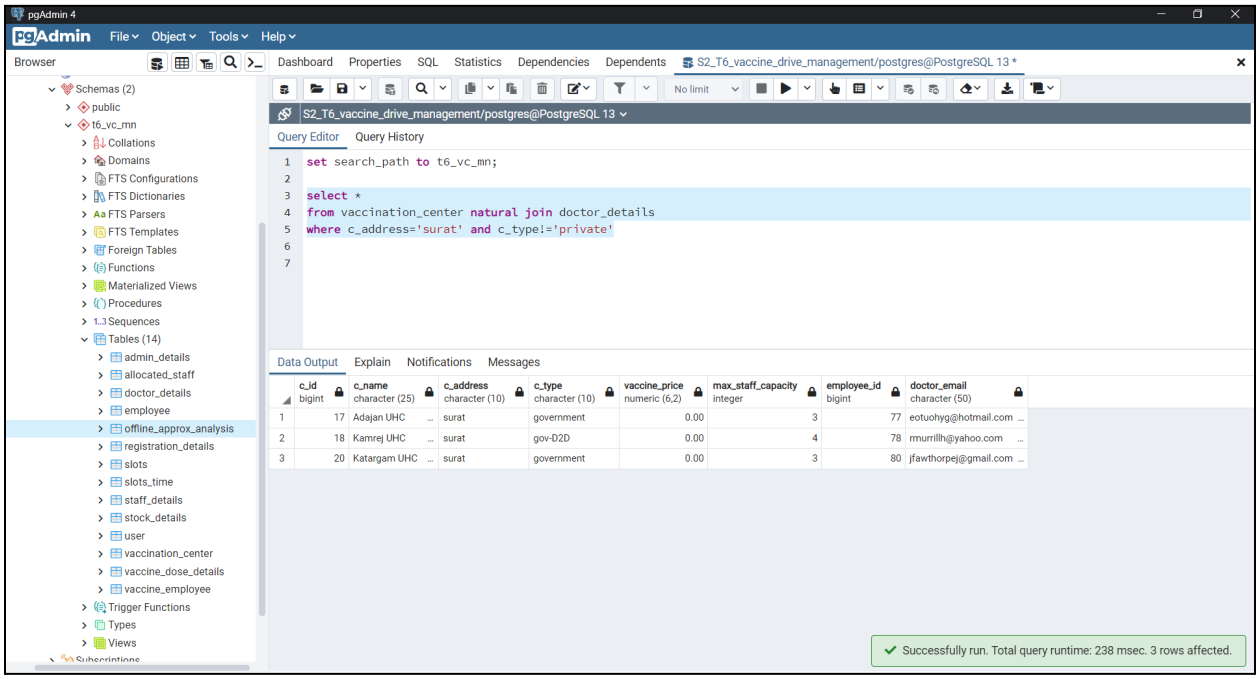
```
select count(distinct u_id)
from vaccine_dose_details natural join registration_details
where (date between '2021-9-20' and '2021-10-30') and vaccine_name='varivax'
```



No of tuples : 1
Number of such users : 23

13. Find details of the non profit vaccination center along with the doctor associated with that center that are located in surat.

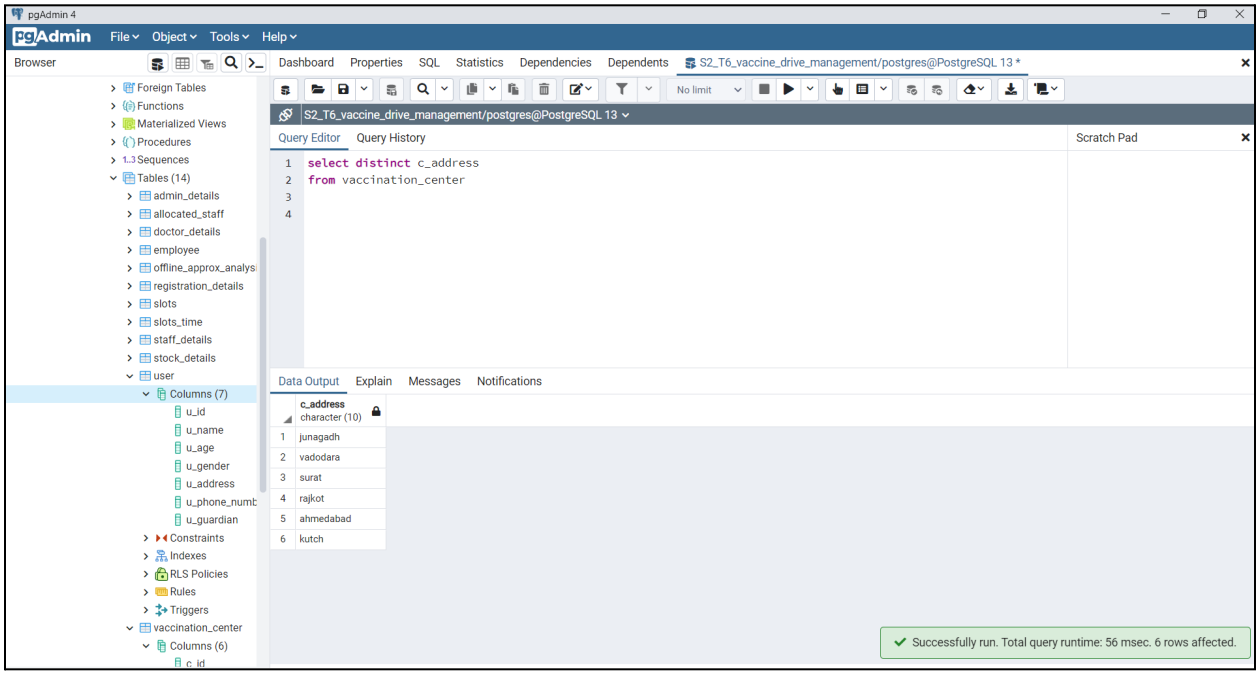
```
select *
from vaccination_center natural join doctor_details
where c_address='surat' and c_type!='private'
```



No of tuples : 3

14. Print all the distinct cities where it is possible to take vaccine

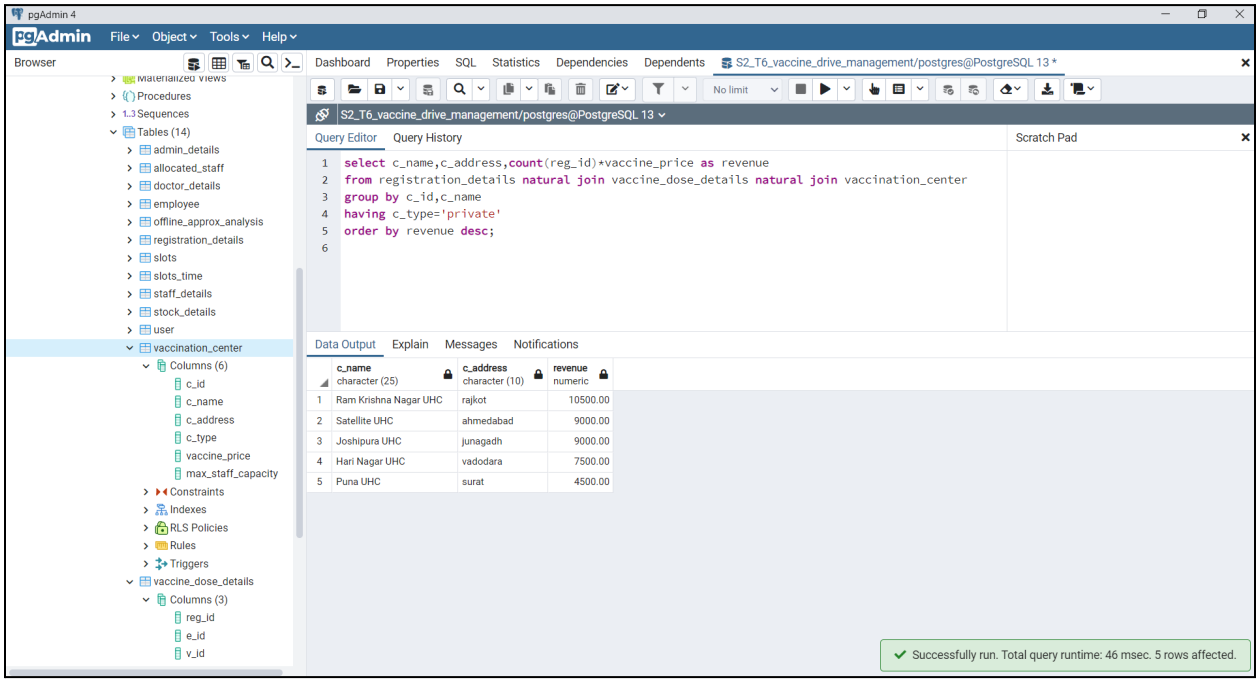
select distinct c_address
from vaccination_center



No. of tuples : 6

15. Calculate the revenue for each private vaccination center

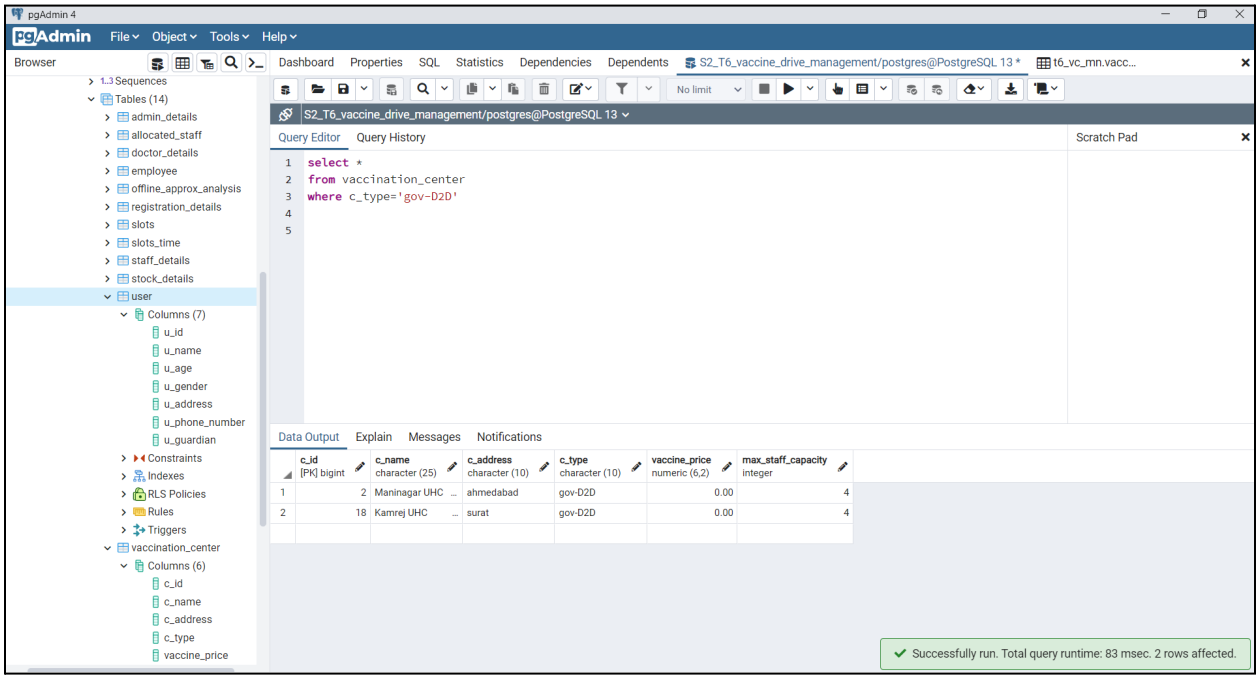
```
select c_name,c_address,count(reg_id)*vaccine_price as revenue
from registration_details natural join vaccine_dose_details natural join vaccination_center
group by c_id,c_name
having c_type='private'
order by revenue desc;
```



No. of tuples : 5

16. List the vaccination centers where door-to-door service is available

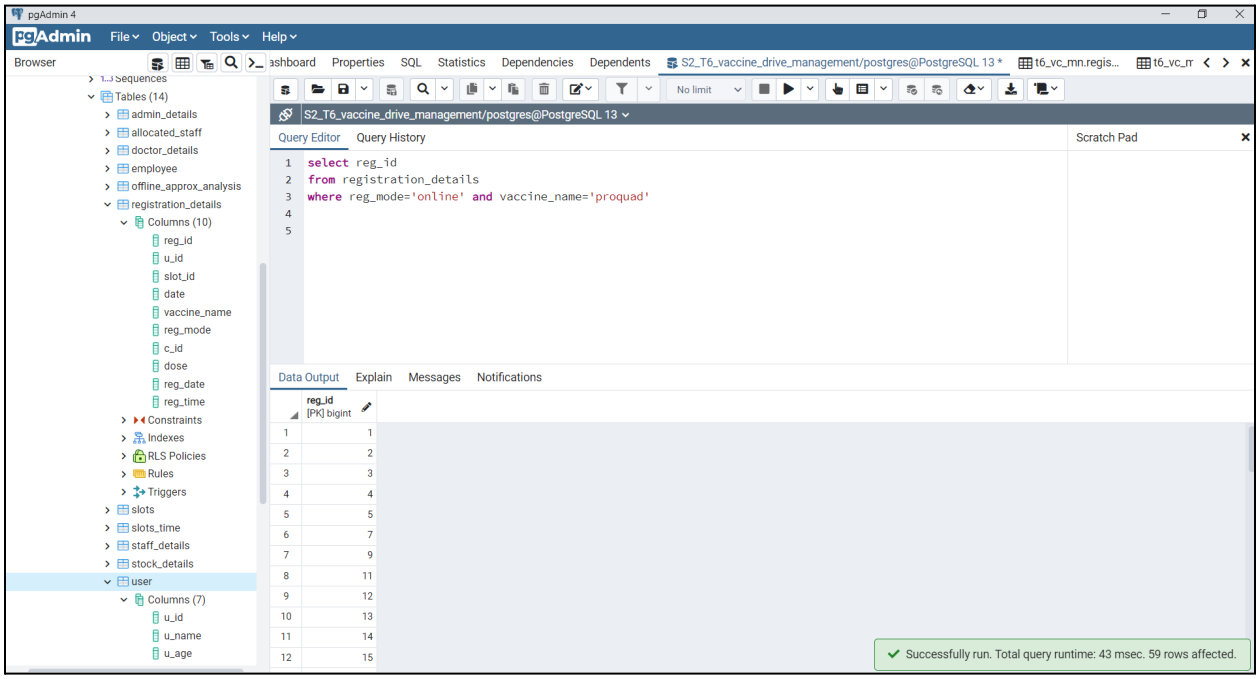
```
select *
from vaccination_center
where c_type='gov-D2D'
```



No. of tuples : 2

17. Give the registration id of all users who have registered online for proquad vaccine.

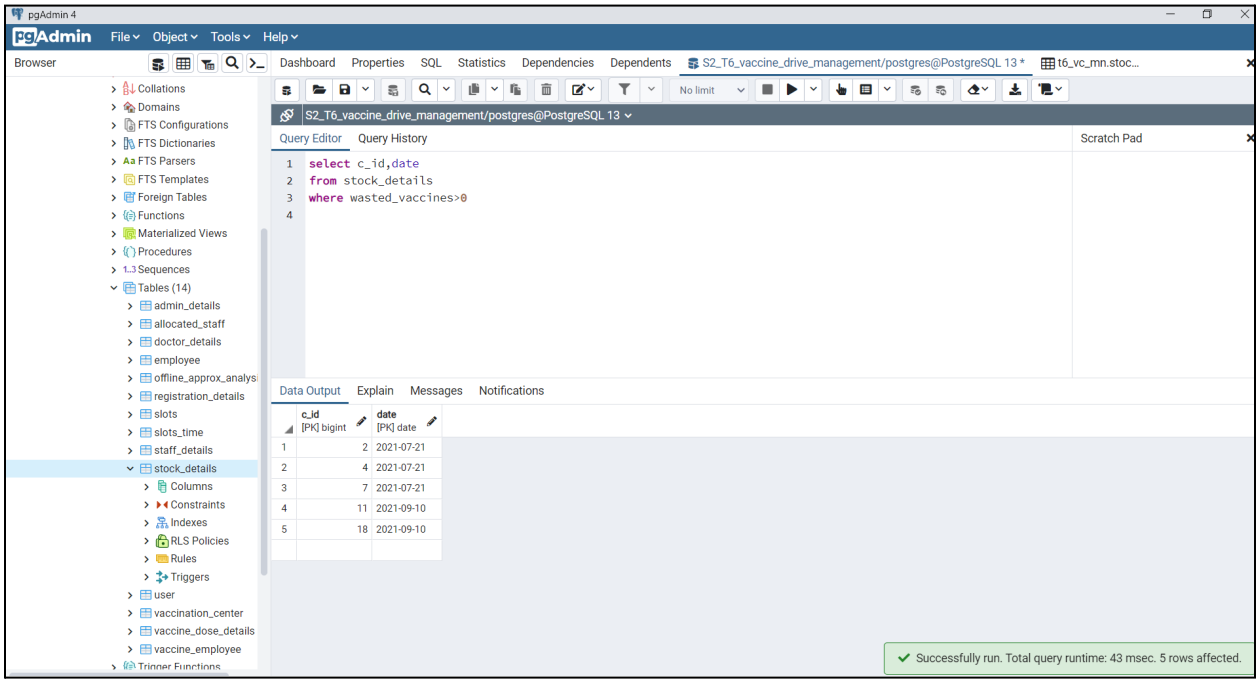
```
select reg_id
from registration_details
where reg_mode='online' and vaccine_name='proquad'
```



No. of tuples : 59

18. List out the centers and dates when some vaccines were wasted.

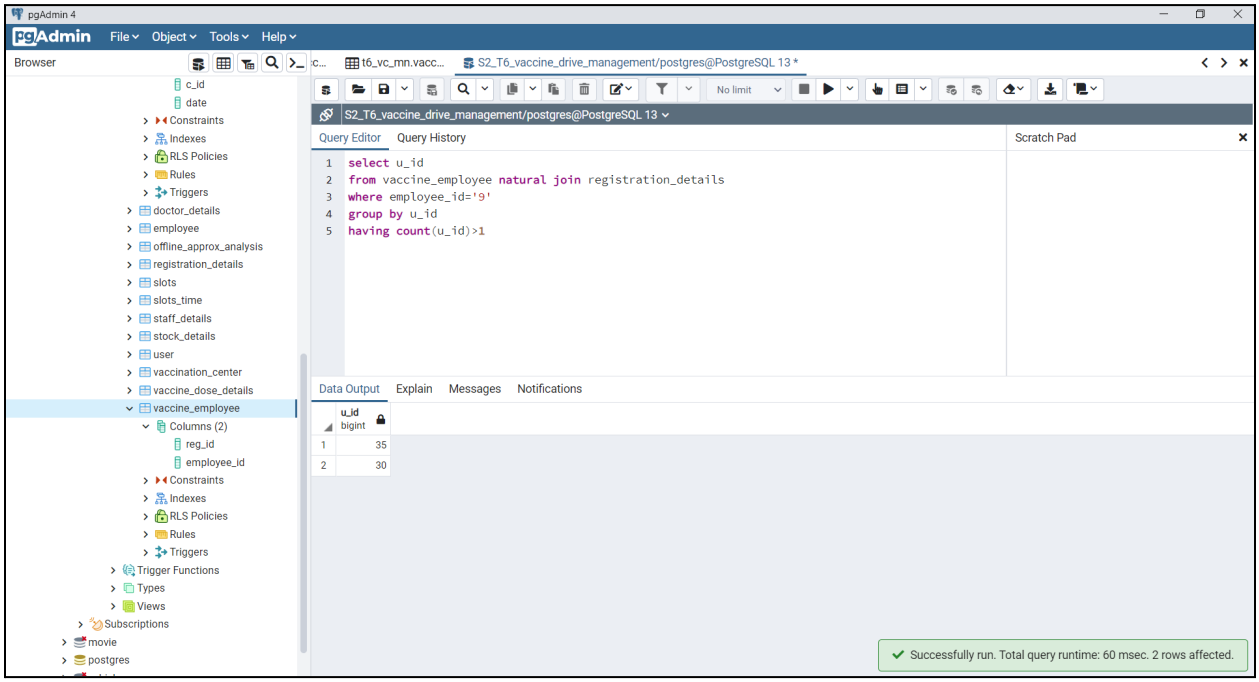
```
select c_id,date
from stock_details
where wasted_vaccines>0
```



No. of tuples : 5

19. Find user_id of all those patients who were attended to more than once by employee id 9.

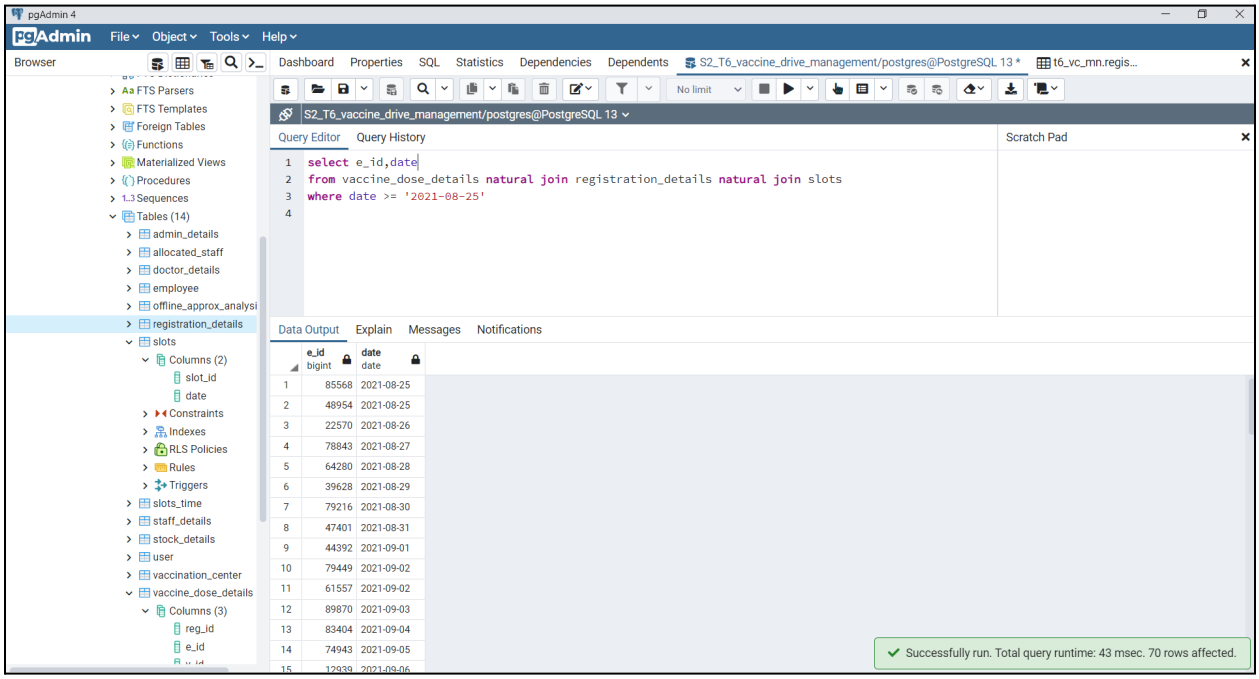
```
select u_id
from vaccine_employee natural join registration_details
where employee_id='9'
group by u_id
having count(u_id)>1
```



No. of Tuples : 2

20. List the certificate ids of all users that took the vaccine on or after 25th August 2021.

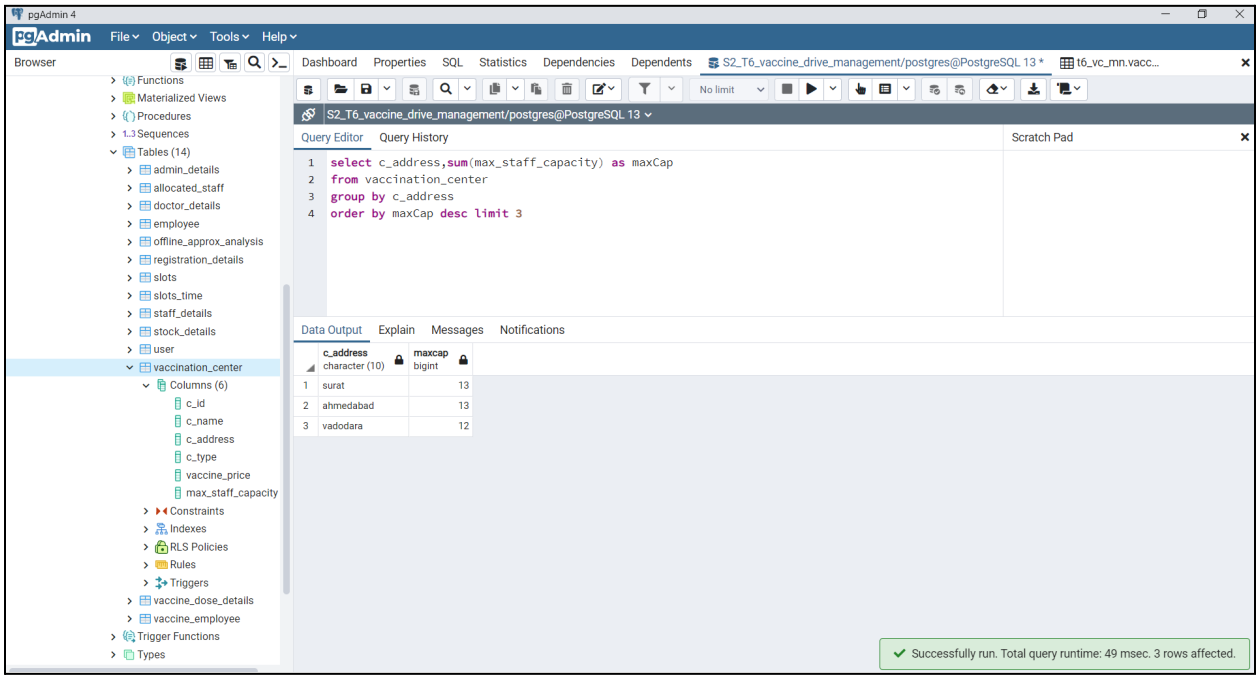
```
select e_id,date
from vaccine_dose_details natural join registration_details natural join slots
where date >= '2021-08-25'
```



No. of Tuples : 70

21. Give the top 3 cities that have the maximum total staff capacity.

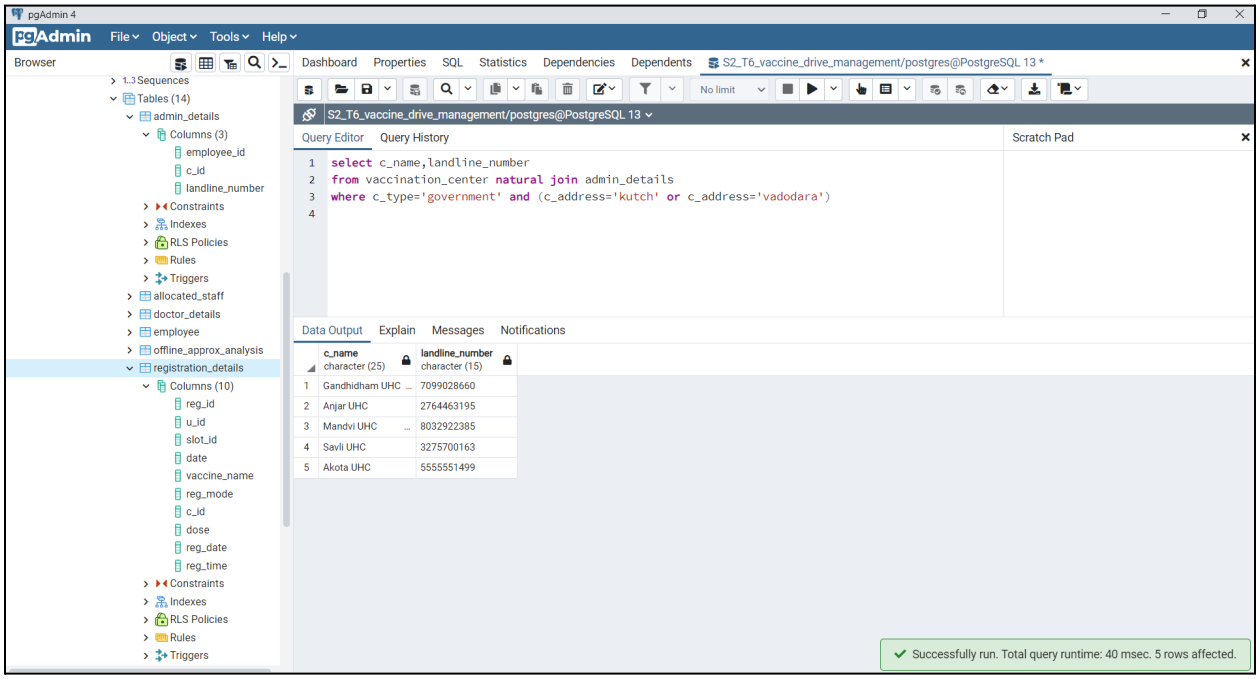
```
select c_address,sum(max_staff_capacity) as maxCap
from vaccination_center
group by c_address
order by maxCap desc limit 3
```



No. of Tuples : 3

22. List the admin landline numbers of government vaccine centers in kutch or vadodara

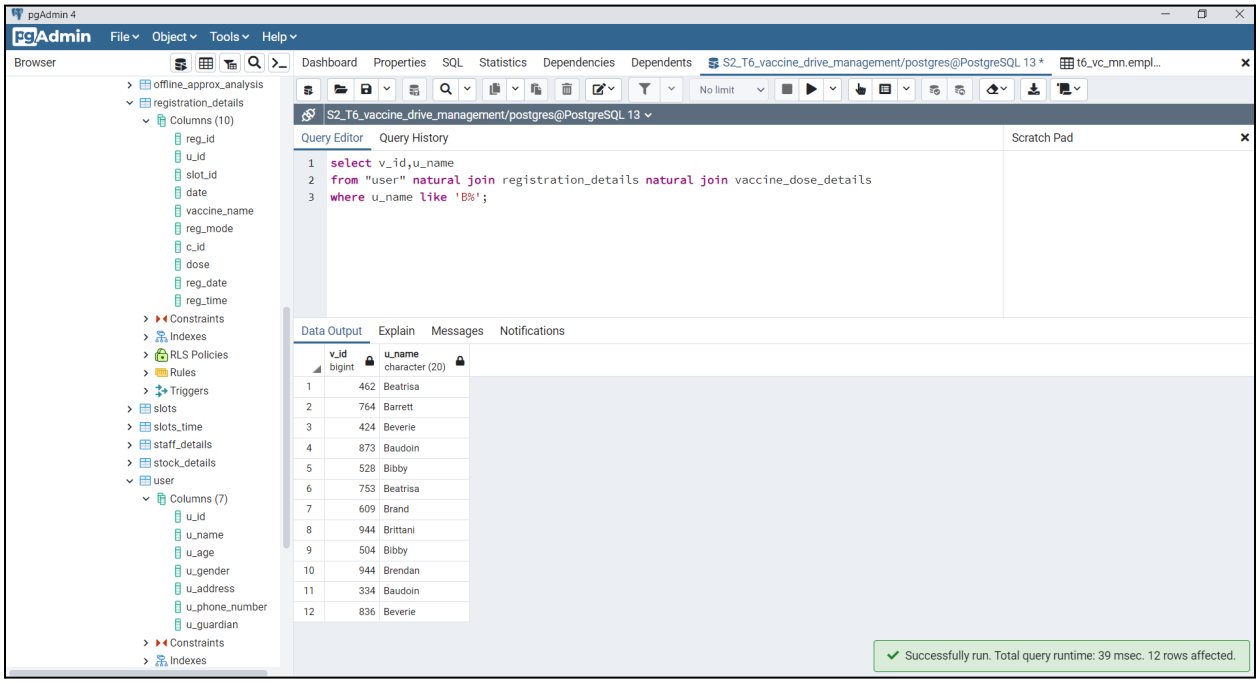
```
select c_name,landline_number
from vaccination_center natural join admin_details
where c_type='government' and (c_address='kutch' or c_address='vadodara')
```



No. of Tuples : 5

23. Print the vaccine ids of all users whose name starts with B.

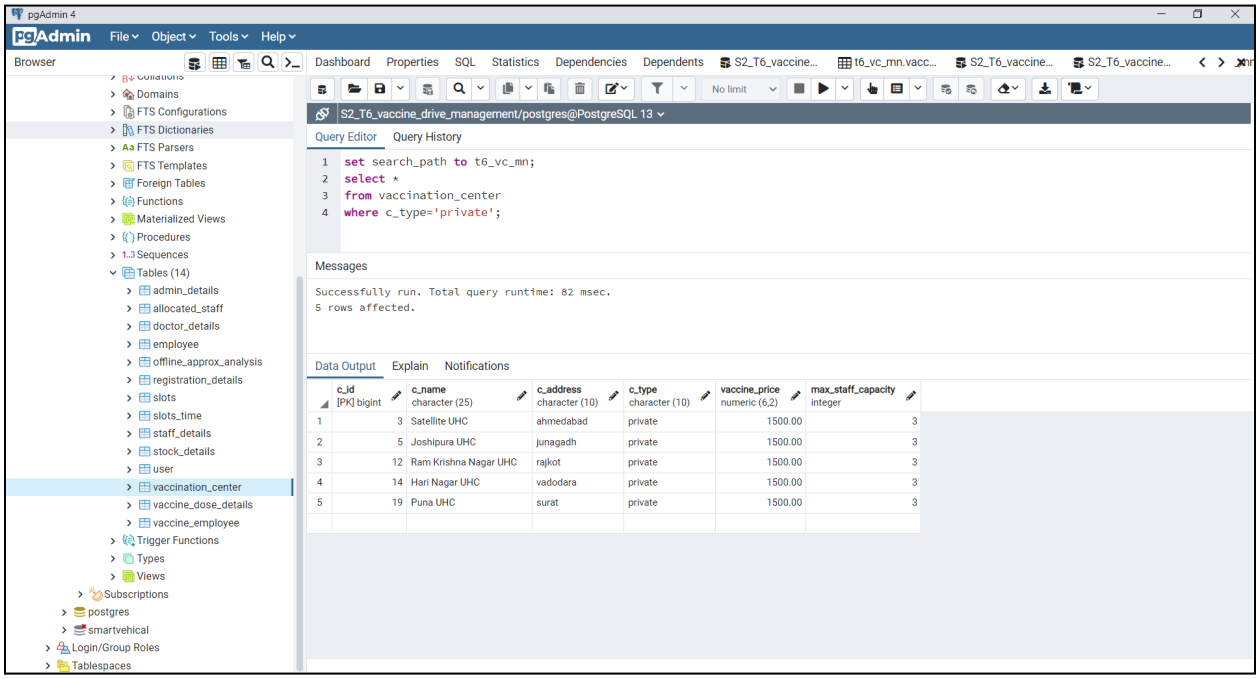
```
select v_id,u_name
from "user" natural join registration_details natural join vaccine_dose_details
where u_name like 'B%';
```



Number of tuples : 12

24. List out all the details of private vaccination centers available in every city.

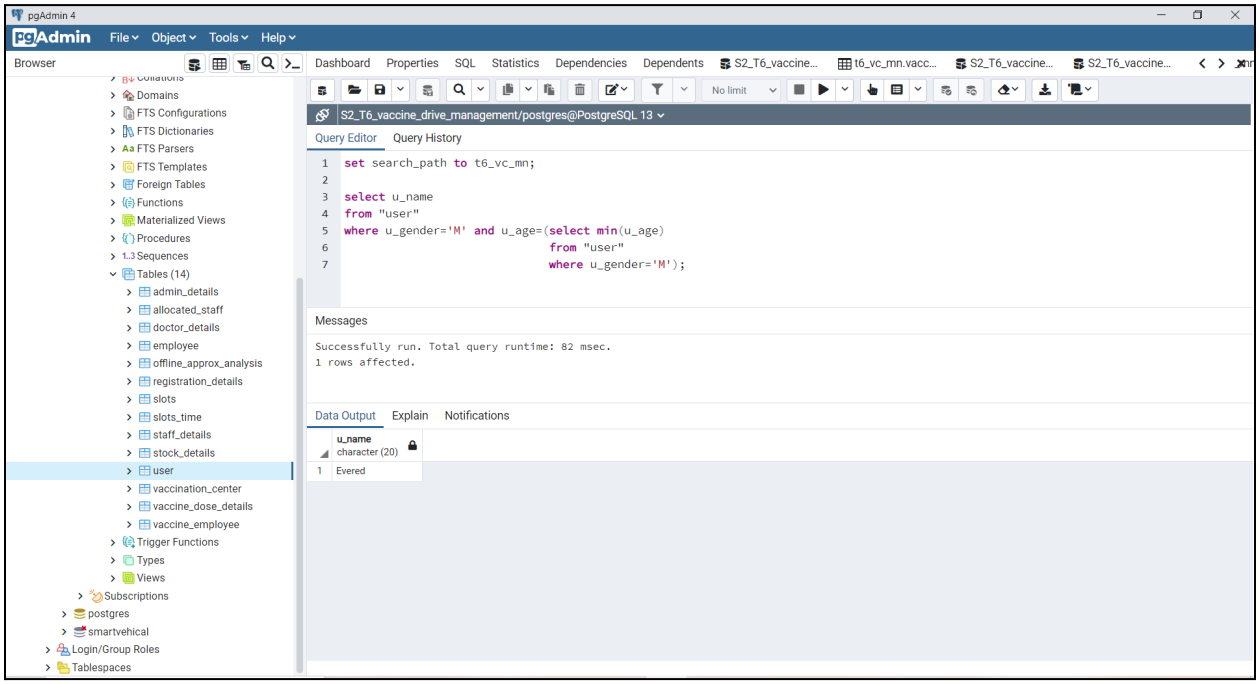
```
select *
from vaccination_center
where c_type='private';
```



No. of tuples : 5

25. Find the names of the youngest male users.

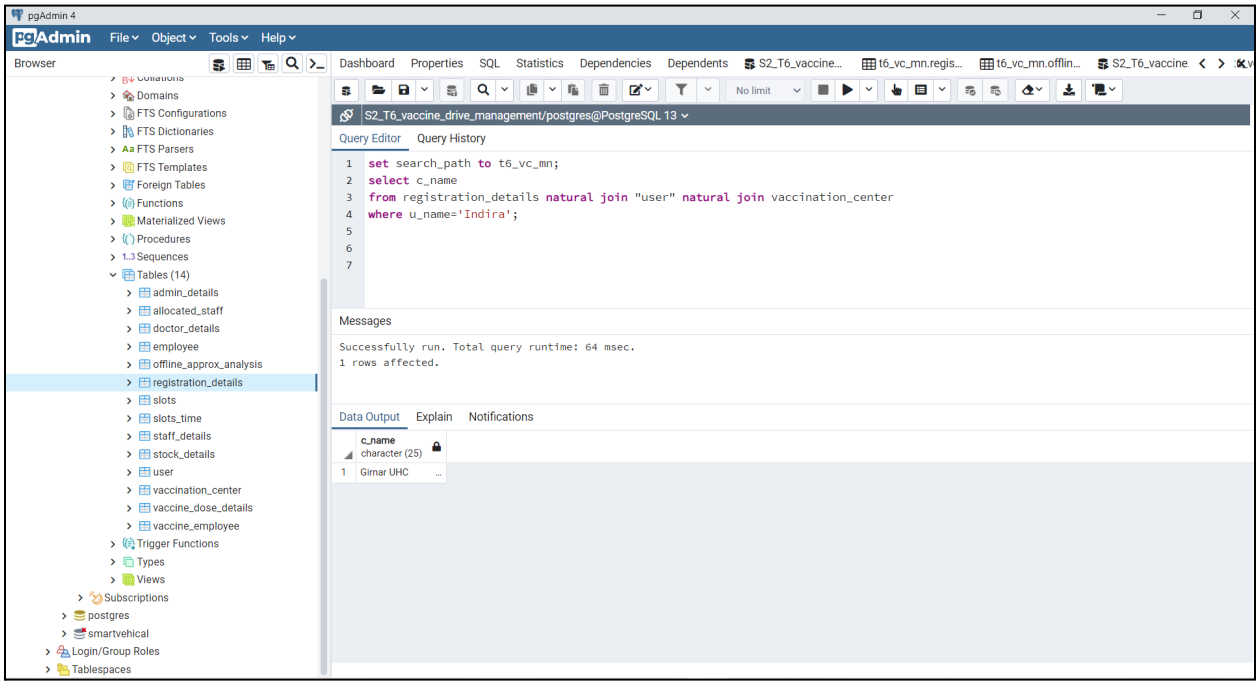
```
select u_name
from "user"
where u_gender='M' and u_age=(select min(u_age)
                             from "user"
                             where u_gender='M');
```



No. of tuples : 1

26. Print the vaccination centers' names visited by ‘Indira’.

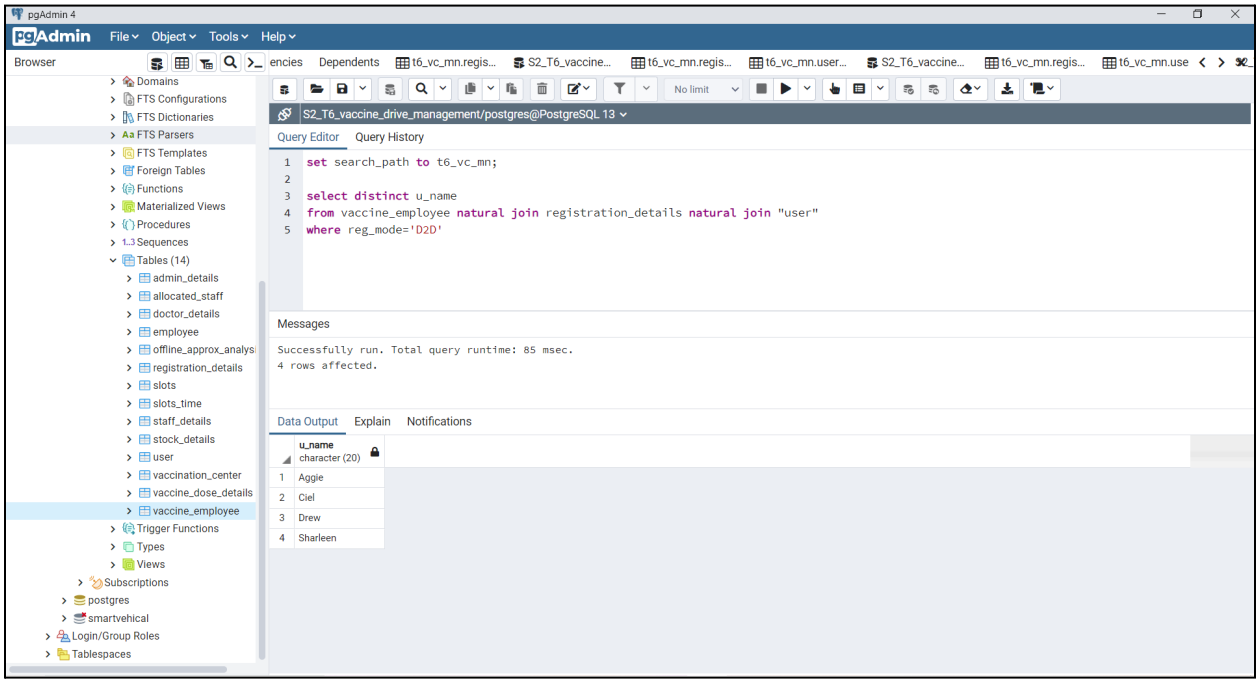
```
select c_name
from registration_details natural join "user" natural join vaccination_center
where u_name='Indira';
```



No. of tuples : 1

27. Find the name of users who take vaccines by door to door service.

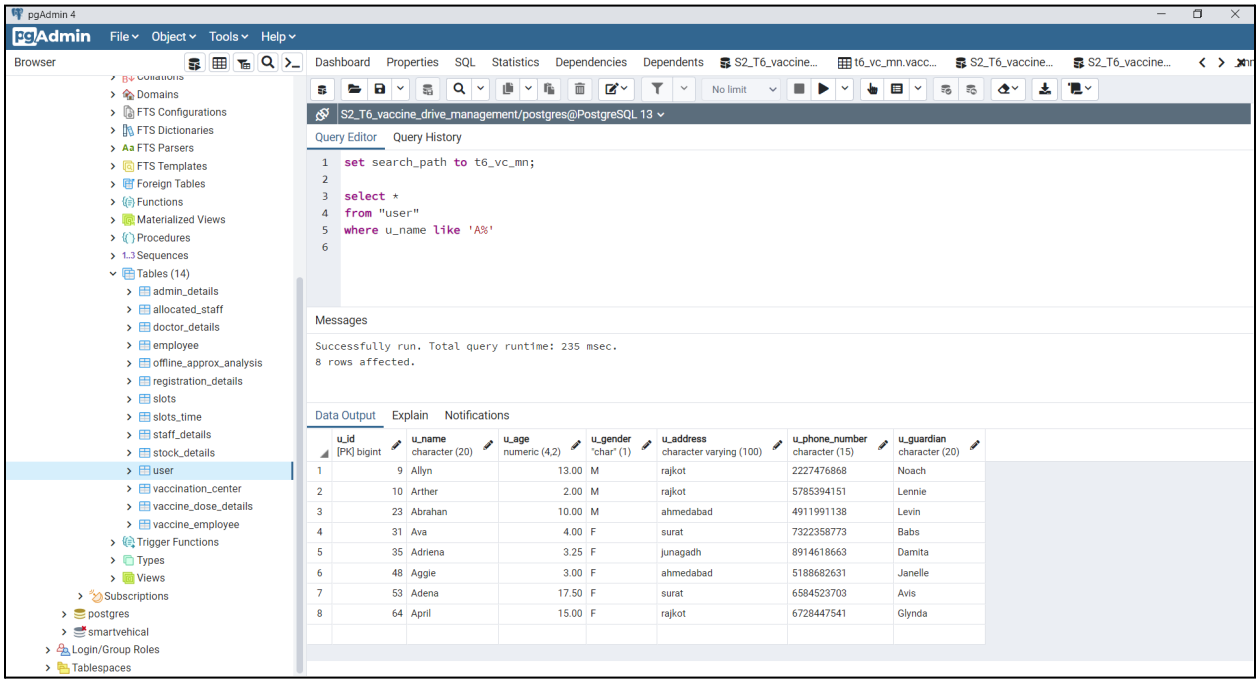
```
select distinct u_name
from vaccine_employee natural join registration_details natural join "user"
where reg_mode='D2D'
```



No. of tuples : 4

28. Give the details of users whose name starts with ‘A’.

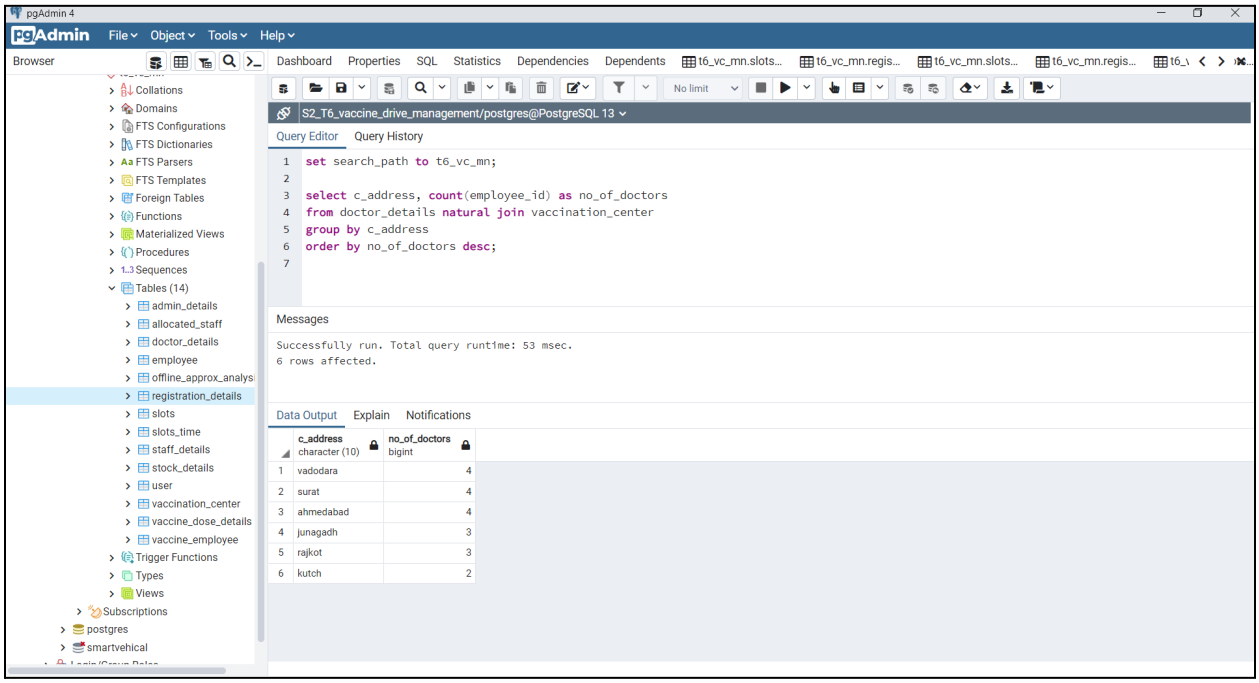
```
select *
from "user"
where u_name like 'A%'
```



No. of tuples : 8

29. Find out how many doctors are available in every city.

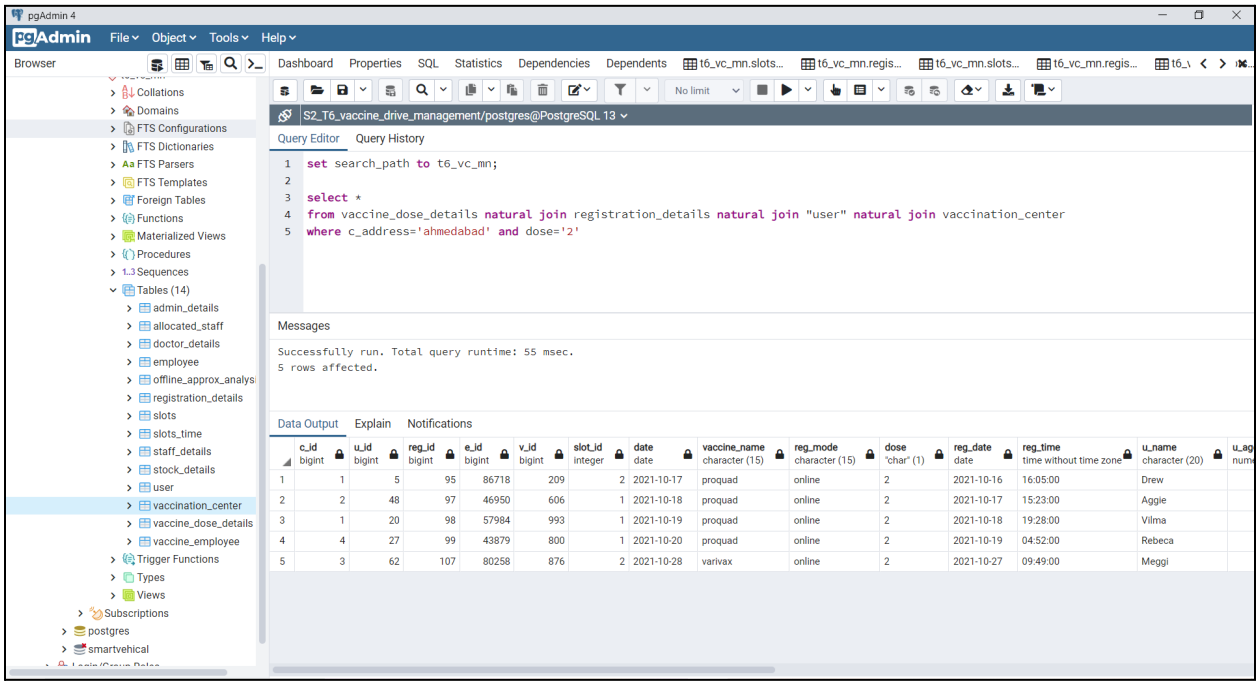
```
select c_address, count(employee_id) as no_of_doctors
from doctor_details natural join vaccination_center
group by c_address
order by no_of_doctors desc;
```



No. of tuples : 6

30. Give all details of users who visited the vaccination center located at ahmedabad and take a second dose of vaccine.

```
select *
from vaccine_dose_details natural join registration_details natural join "user" natural join vaccination_center
where c_address='ahmedabad' and dose='2'
```

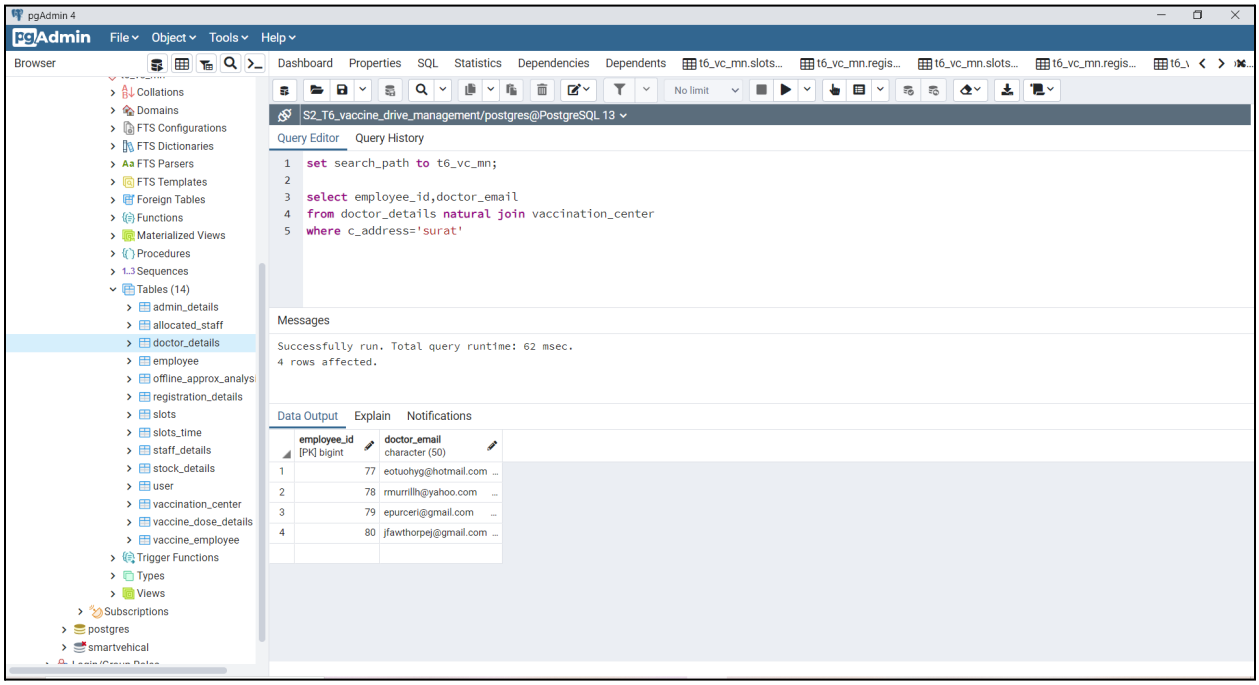


	c_id bigint	u_id bigint	reg_id bigint	e_id bigint	v_id bigint	slot_id integer	date date	vaccine_name character (15)	reg_mode character (15)	dose "char" (1)	reg_date date	reg_time time without time zone	u_name character (20)
1	1	5	95	86718	209	2	2021-10-17	proquad	online	2	2021-10-16	16:05:00	Drew
2	2	48	97	46950	606	1	2021-10-18	proquad	online	2	2021-10-17	15:23:00	Aggie
3	1	20	98	57984	993	1	2021-10-19	proquad	online	2	2021-10-18	19:28:00	Vilma
4	4	27	99	43879	800	1	2021-10-20	proquad	online	2	2021-10-19	04:52:00	Rebeca
5	3	62	107	80258	876	2	2021-10-28	varivax	online	2	2021-10-27	09:49:00	Meggi

No. of tuples : 5

31.Give the details of the doctor available at the vaccination center located at surat.

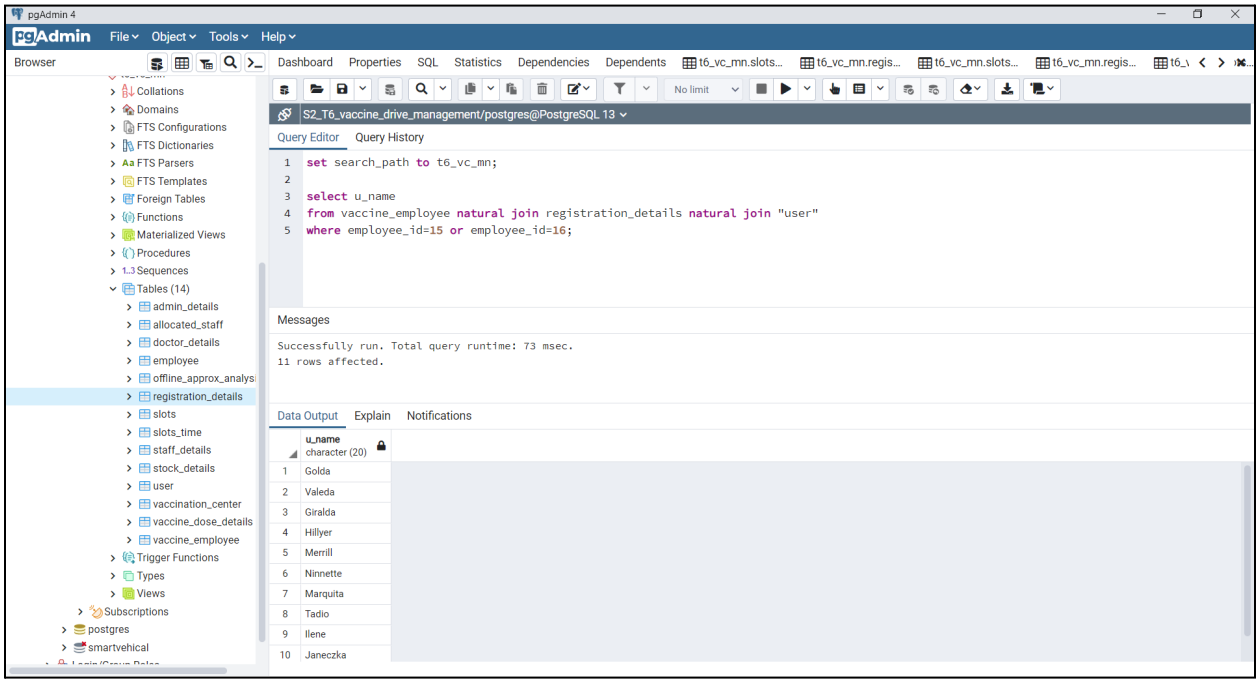
```
select employee_id,doctor_email
from doctor_details natural join vaccination_center
where c_address='surat'
```



No. of tuples : 4

32. Give the name of users who were attended by employee id 15 or 16.

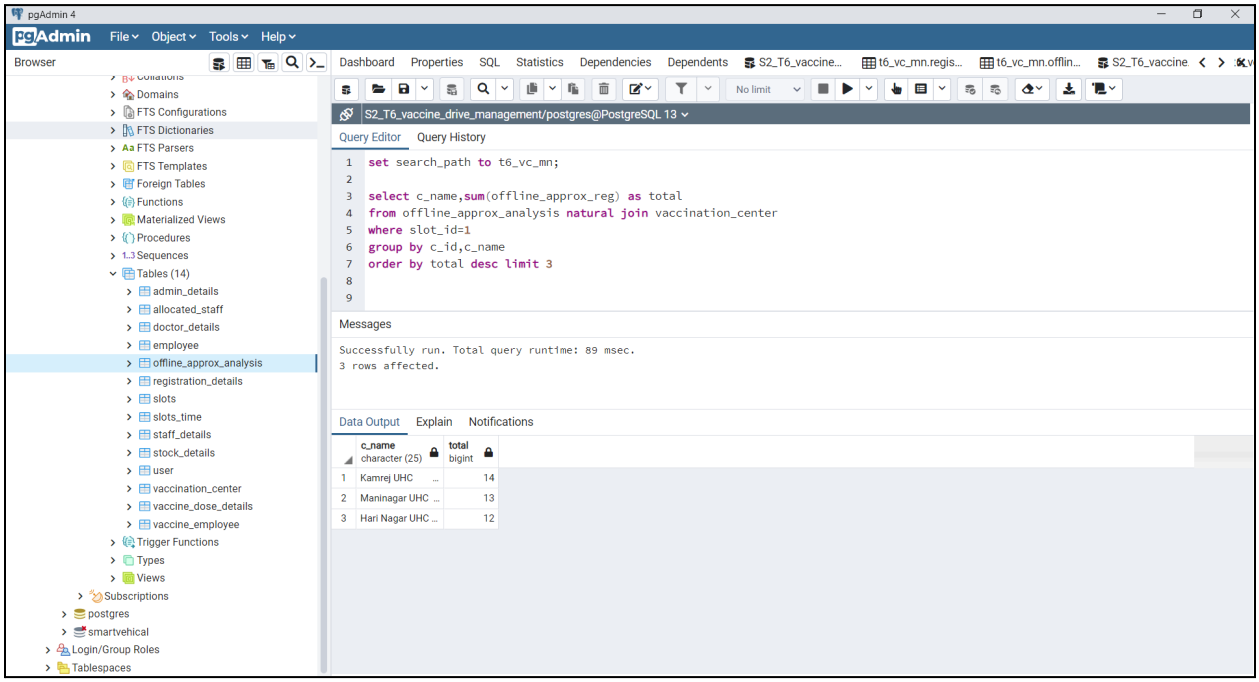
```
select u_name
from vaccine_employee natural join registration_details natural join "user"
where employee_id=15 or employee_id=16;
```



No. of tuples : 11

33. Find top 3 vaccination centers which have maximum offline approximate registration in slot 1.

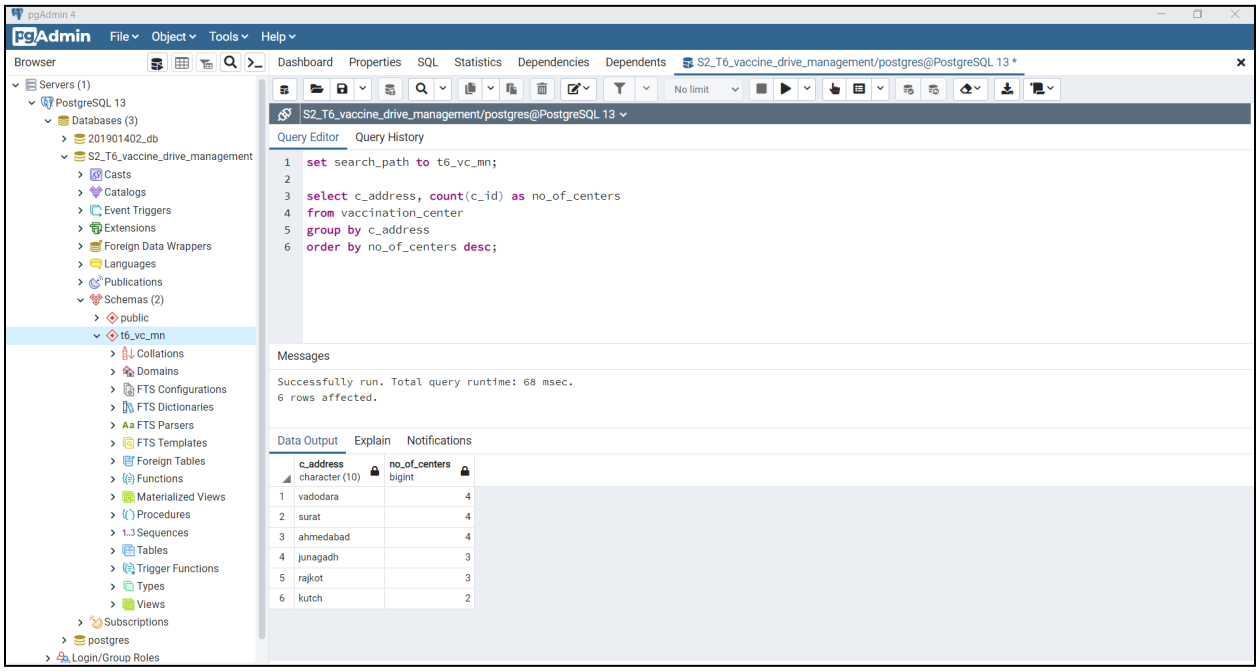
```
select c_name,sum(offline_approx_reg) as total
from offline_approx_analysis natural join vaccination_center
where slot_id=1
group by c_id,c_name
order by total desc limit 3
```



No. of tuples : 3

34. Find out how many vaccination centers are there in every city.

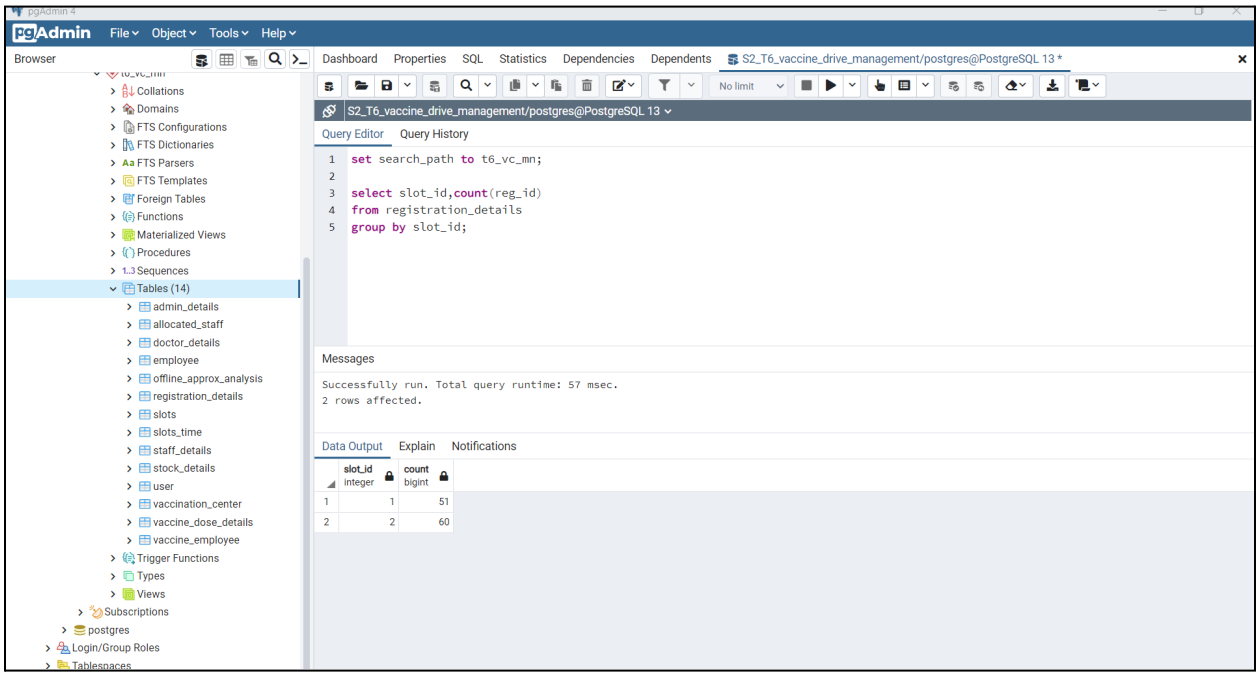
```
select c_address, count(c_id) as no_of_centers
from vaccination_center
group by c_address
order by no_of_centers desc;
```



No. of tuples = 6.

35. Which slot is more preferable by the users.

```
select slot_id,count(reg_id)
from registration_details
group by slot_id;
```

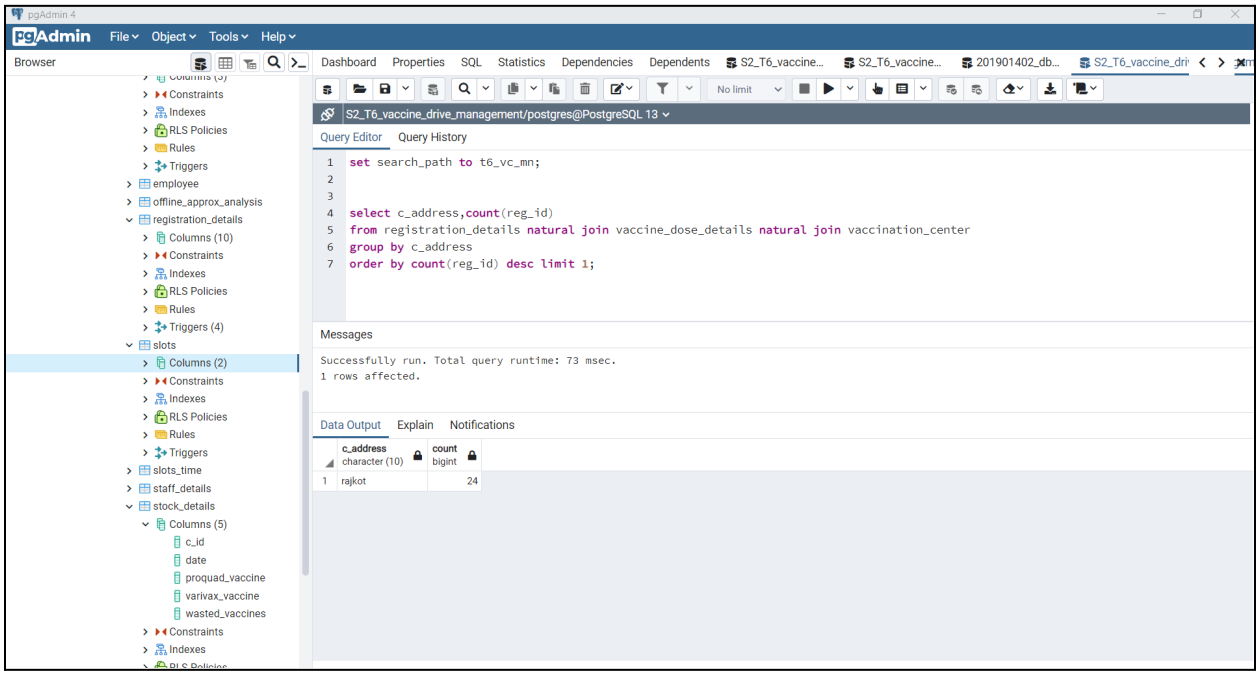


According to past data, slot 2 is chosen more often by the users.

No. of tuples = 2.

36. Give the name of the city which has provided maximum vaccination.

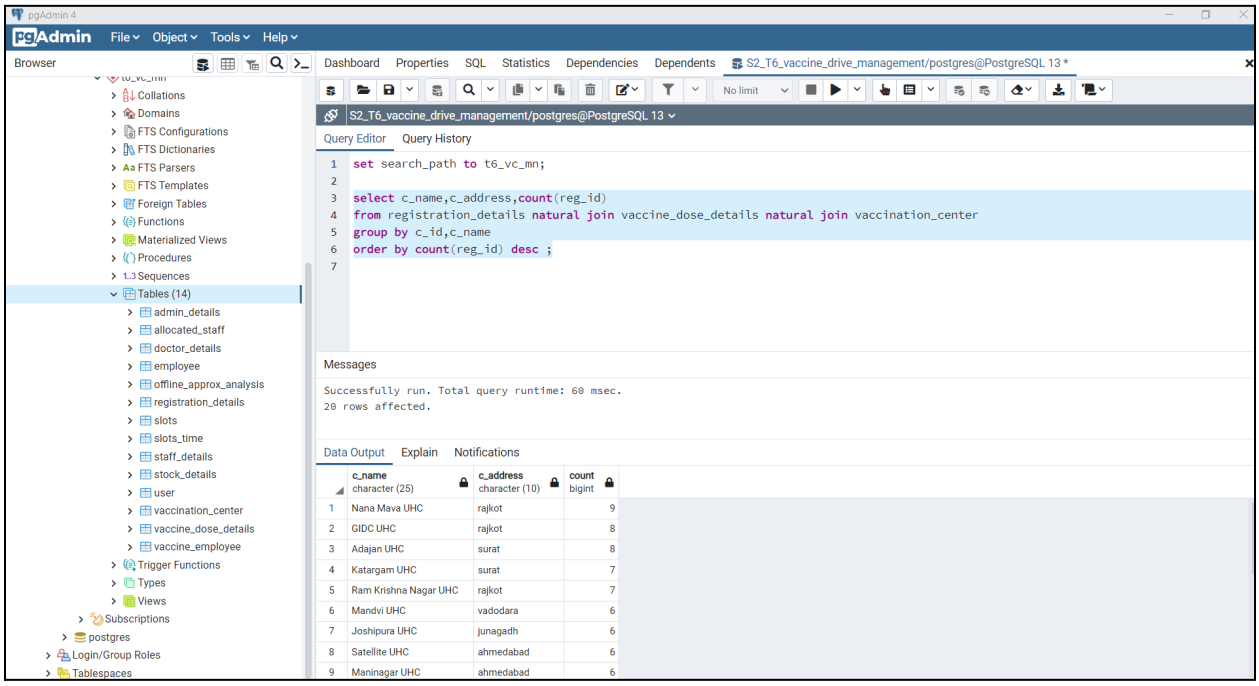
```
select c_address,count(reg_id)
from registration_details natural join vaccine_dose_details natural join vaccination_center
group by c_address
order by count(reg_id) desc limit 1;
```



No. of tuples = 1.

37. List out vaccination centers and users attended by the center in decreasing order.

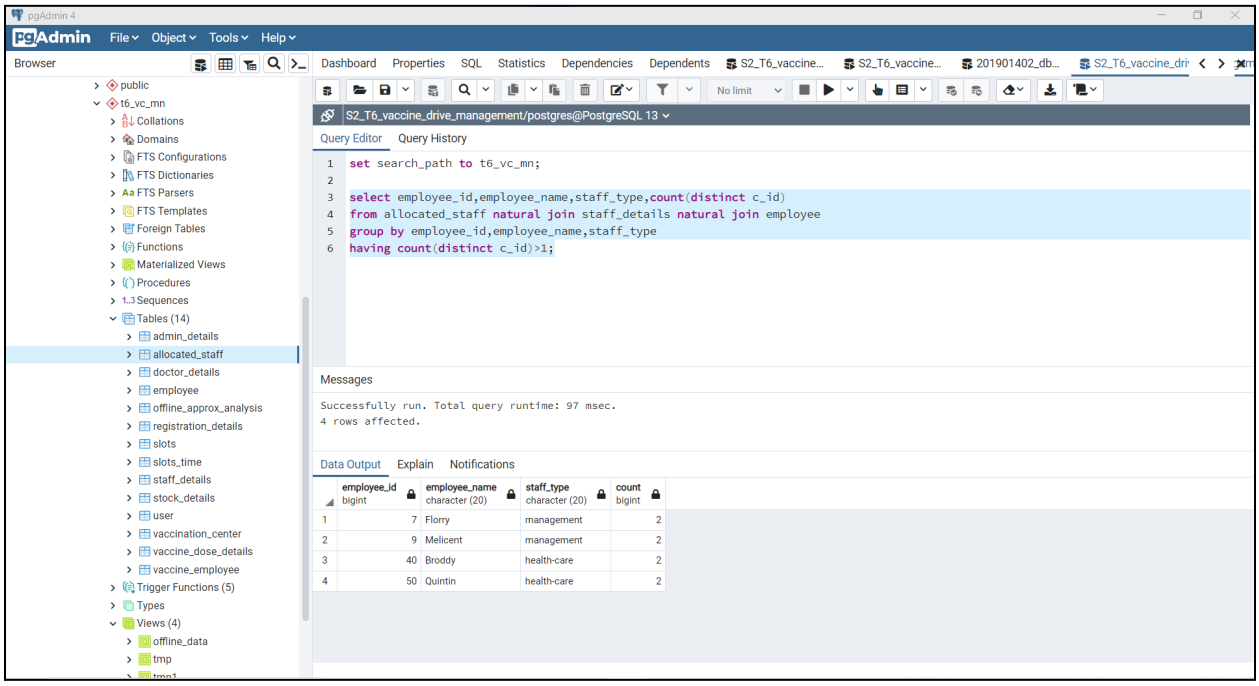
```
select c_name,c_address,count(reg_id)
from registration_details natural join vaccine_dose_details natural join vaccination_center
group by c_id,c_name
order by count(reg_id) desc;
```



No. of tuples = 20.

38. Give the details of staff who have worked at more than one vaccination centers.

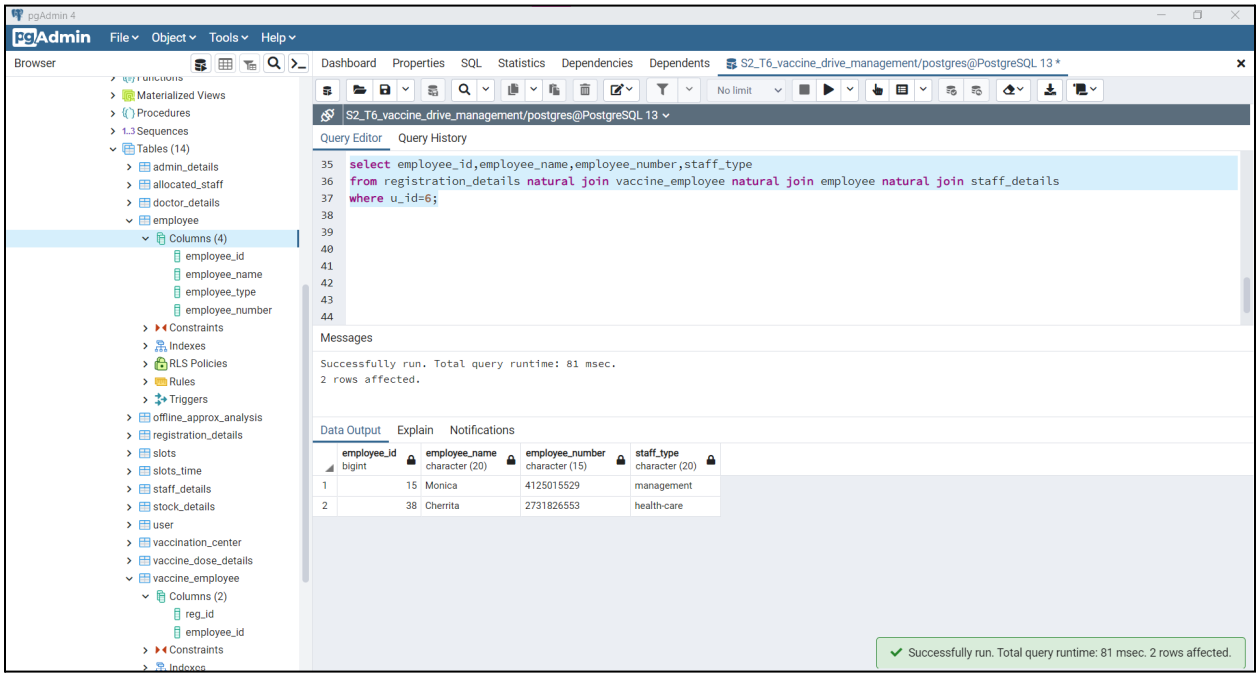
```
select employee_id,employee_name,staff_type,count(distinct c_id)
from allocated_staff natural join staff_details natural join employee
group by employee_id,employee_name,staff_type
having count(distinct c_id)>1;
```



No. of tuples = 4.

39. Give the details of employees who have attended user_id 6.

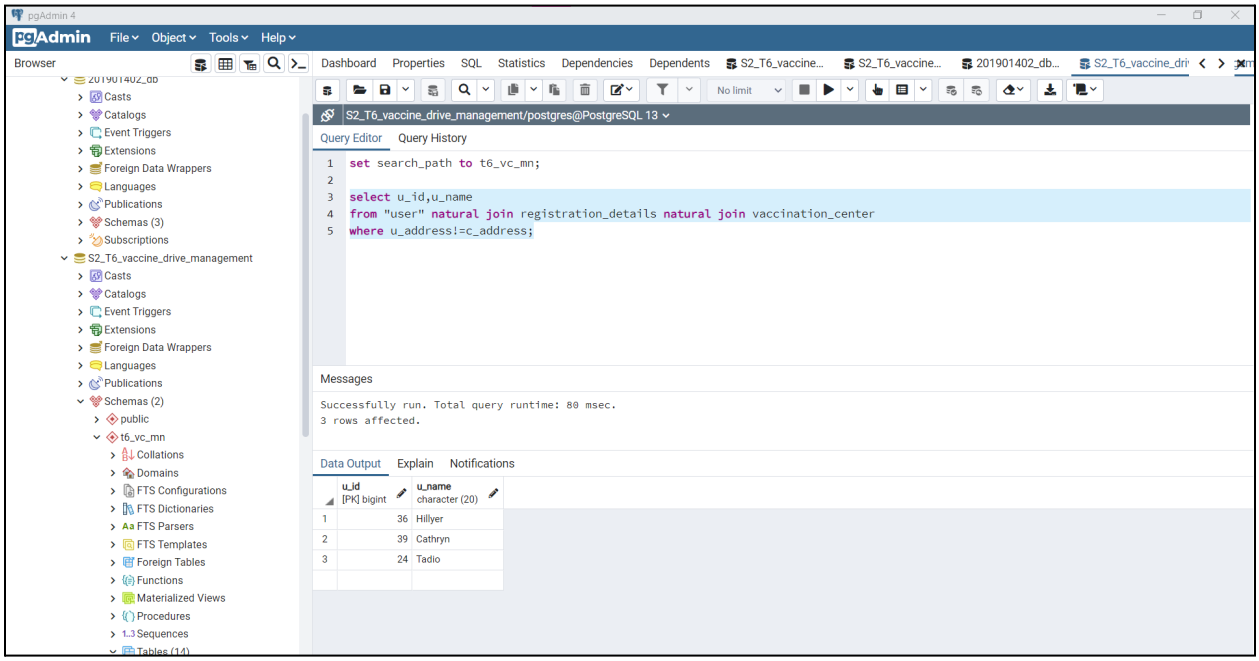
select employee_id,employee_name,employee_number,staff_type
from registration_details natural join vaccine_employee natural join employee natural join staff_details
where u_id=6;



No. of tuples = 2.

40. Give details of the users who have not registered for the vaccine in their own city.

```
select u_id,u_name
from "user" natural join registration_details natural join vaccination_center
where u_address!=c_address;
```



No. of tuples = 3.

Section7:

Project Code with output screenshots

Front-end Code

Connect Nodejs interface with PostgreSQL Database:

Code:

```
const { Client } = require('pg');
const scanf = require('scanf');

const client = new Client({
   host: "localhost",
   user: "postgres",
   password: "admin",
   database: "S2_T6_vaccine_drive_management"
})
client.connect();

console.log("\n1: New Registration");
console.log("2: View Registration details");
console.log("3: Update Registration Details");
console.log("4: Delete Registration");


console.log("\nSelect your choice to proceed: ")
var c = scanf("%d");
console.log("Your query %d is being processed...", c);

switch (c) {
   case 1:
   {
      client.query('set search_path to t6_vc_mn')
      client.query("INSERT INTO t6_vc_mn.user(u_id, u_name, u_age, u_gender, u_address, u_phone_number,
u_guardian) VALUES('87','Kavya','20','F','ahmedabad','9585849844','Kavya')",(err,result) =>
      {
         if(!err)
         {
            console.log("\nNew row is successfully Inserted in User's table\n")
         }
         else
            console.log("Error in Inserting\n")
      })
```

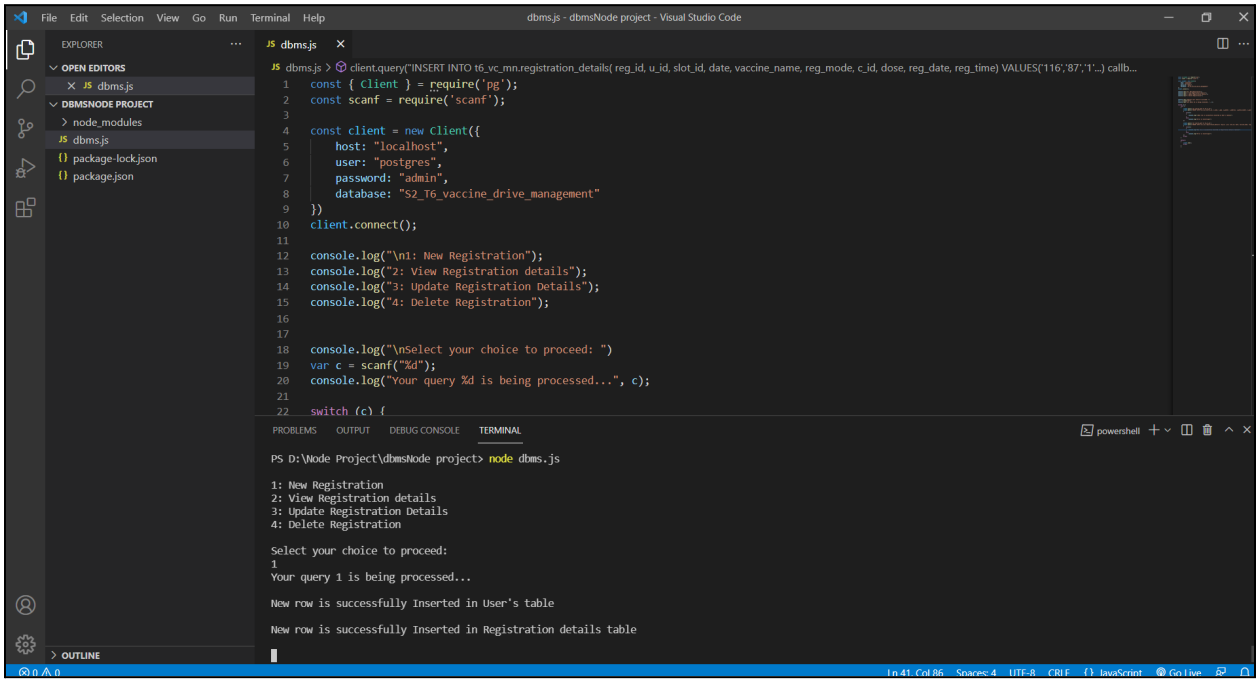
```
      client.query('set search_path to t6_vc_mn')
      client.query("INSERT INTO t6_vc_mn.registration_details( reg_id, u_id, slot_id, date, vaccine_name,
reg_mode, c_id, dose, reg_date, reg_time)
VALUES('116','87','1','2021-07-29','varivax','online','1','1','2021-07-28','20:15:00')",(err,result)=>
      {
        if(!err)
        {
          console.log("New row is successfully Inserted in Registration details table\n")
        }
        else
          console.log("Error in Inserting\n")
      })
      break;
   }

   case 2:
   {
      console.log("Enter Registration ID: ");
      var regis=scanf("%d");

      client.query('set search_path to t6_vc_mn');
      client.query("select * from registration_details where reg_id=$1",[regis],(err,result) =>
      {
        if(!err)
        {
          console.log("\nGiven below are your registration details\n")
          console.log(result.rows);
        }
        else
          console.log("Error in displaying\n")
      })

      break;
   }

   case 3:
   {
      client.query('set search_path to t6_vc_mn');
      client.query("UPDATE t6_vc_mn.registration_details SET slot_id='2', c_id='3' WHERE
reg_id='116';",(err,result) =>
        {
```

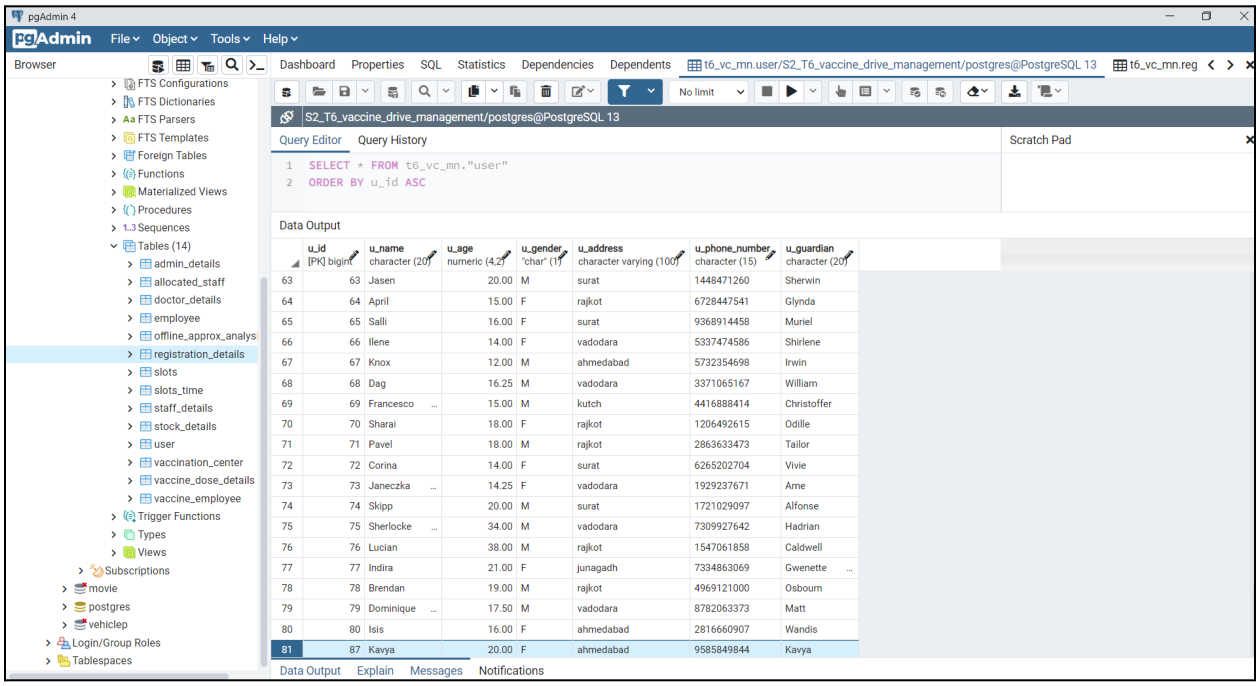
```
            if(!err)
            {
                console.log("Data updated successfully\n")
            }
            else
                console.log("Error in updating\n")
              client.end();
        })
        break;
    }

    case 4:
    {
       client.query('set search_path to t6_vc_mn');
       client.query("Delete from registration_details where reg_id='116'",(err,result) =>
       {
          if(!err)
          {
             console.log("The registration is successfully deleted\n")
          }
          else
             console.log("Error in Deleting\n")
             client.end();
       })
          break;
    }

    default:
    {
       client.query('set search_path to t6_vc_mn')
       console.log("Enter the city: ");
       var city=scanf("%s");
       client.query("select c_id,c_name,c_type,vaccine_price from vaccination_center where
c_address=$1",[city],(err,result) =>
       {
          if(!err)
          {
             console.log("\nThe centres in the given city are: \n")
             console.log(result.rows);
          }
          else
```

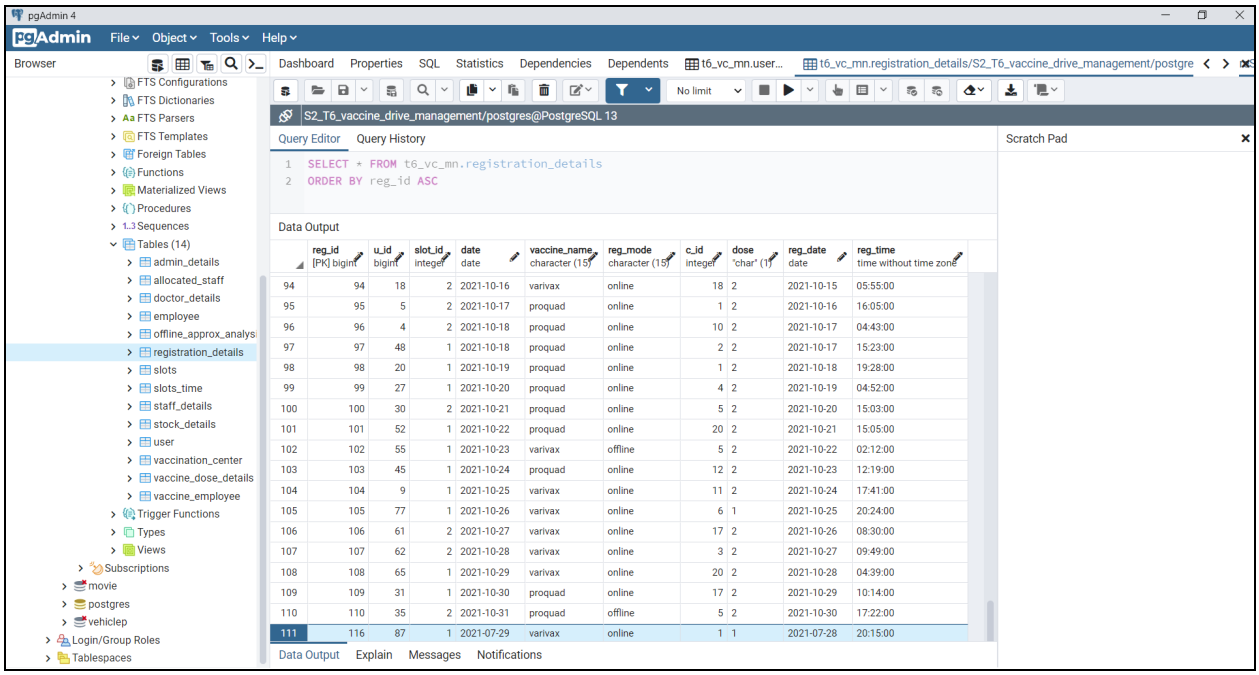
```
            console.log("Error in displaying\n")
        })
        break;
    }
    client.end();
    }
```

Queries and Output Screenshots:

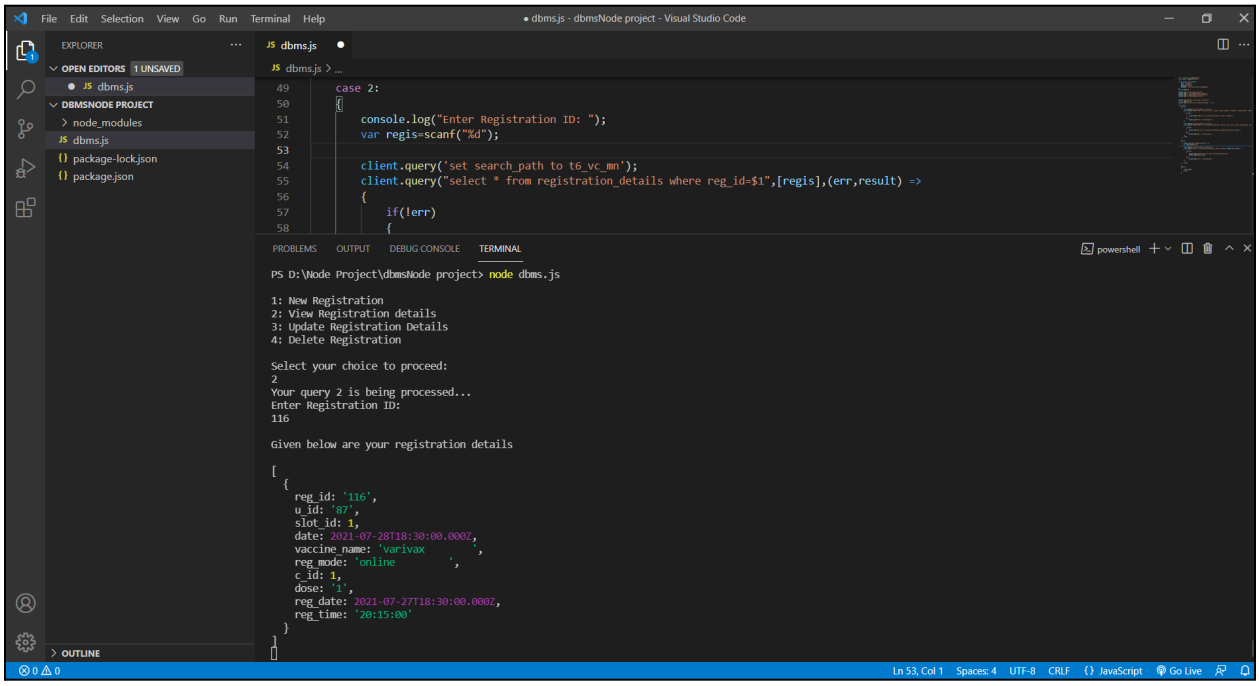
1. Insertion in user and registration_details tables:



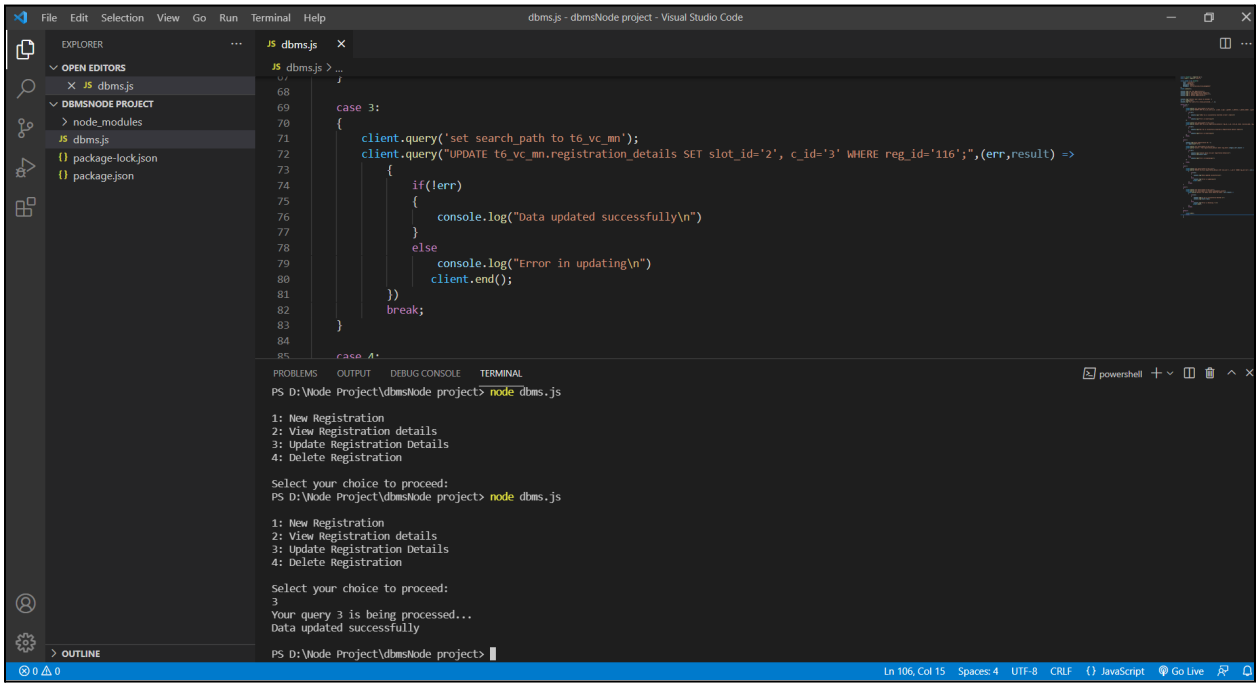


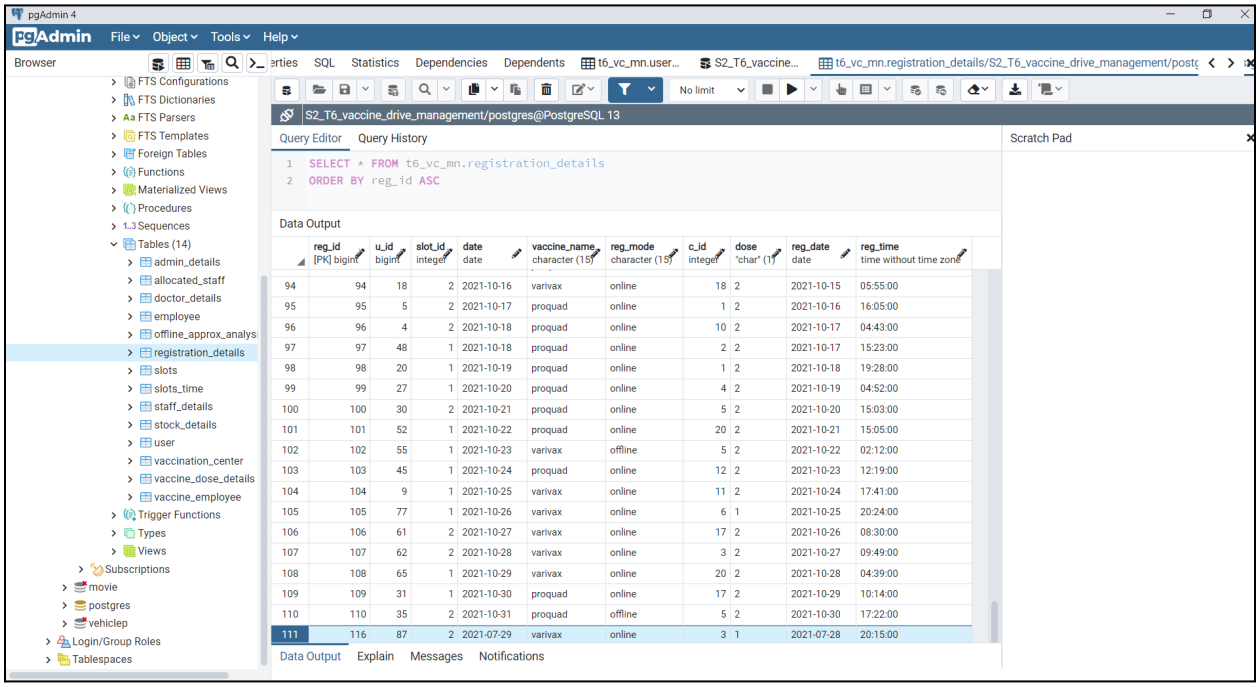


2. View registration details of given reg_id :

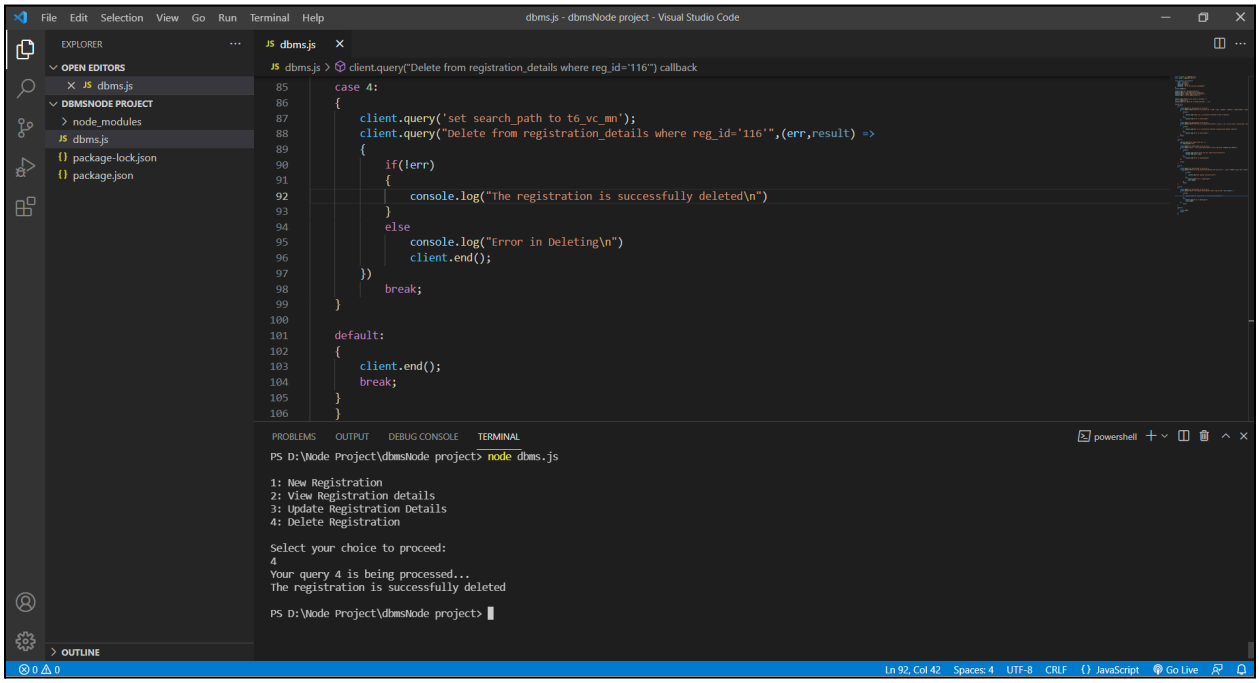


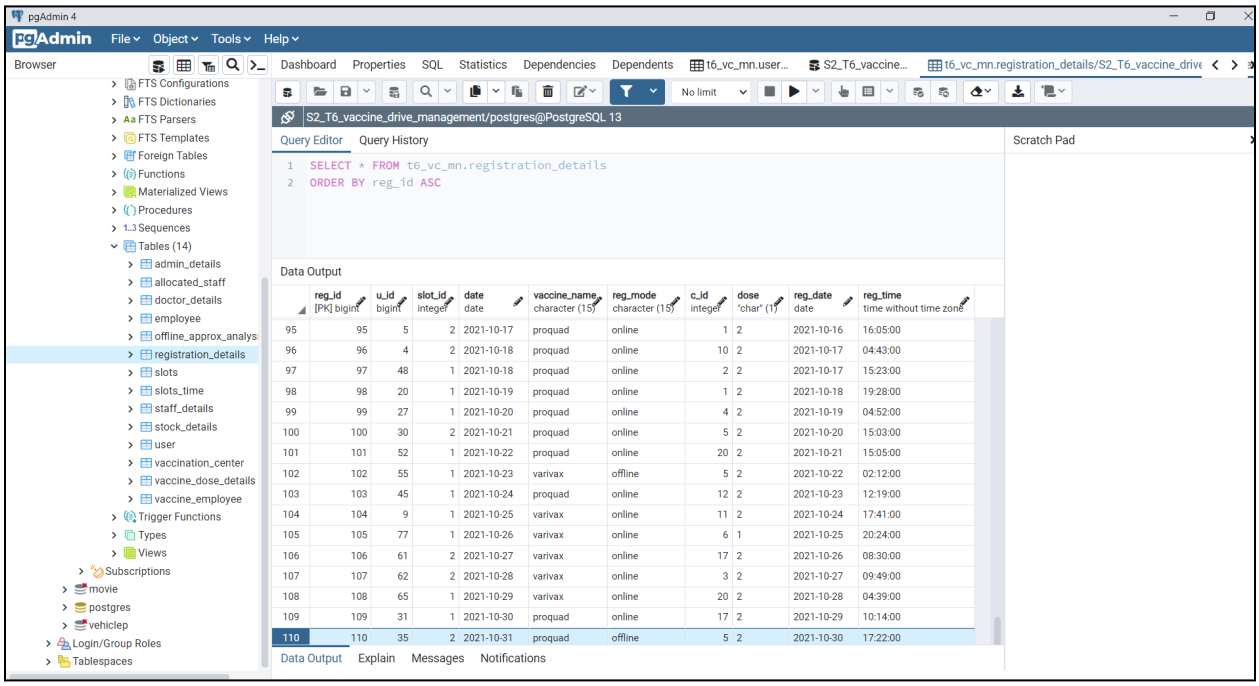
3. Updation in registration_details table:





4. Deletion in registration_details table:





reg_id [PK] bigint	u_id bigint	slot_id integer	date date	vaccine_name character (15)	reg_mode character (15)	c_id integer	dose "char" (1)	reg_date date	reg_time time without time zone
95	5	2	2021-10-17	proquad	online	1	2	2021-10-16	16:05:00
96	4	2	2021-10-18	proquad	online	10	2	2021-10-17	04:43:00
97	48	1	2021-10-18	proquad	online	2	2	2021-10-17	15:23:00
98	20	1	2021-10-19	proquad	online	1	2	2021-10-18	19:28:00
99	27	1	2021-10-20	proquad	online	4	2	2021-10-19	04:52:00
100	30	2	2021-10-21	proquad	online	5	2	2021-10-20	15:03:00
101	52	1	2021-10-22	proquad	online	20	2	2021-10-21	15:05:00
102	55	1	2021-10-23	varivax	offline	5	2	2021-10-22	02:12:00
103	45	1	2021-10-24	proquad	online	12	2	2021-10-23	12:19:00
104	9	1	2021-10-25	varivax	online	11	2	2021-10-24	17:41:00
105	77	1	2021-10-26	varivax	online	6	1	2021-10-25	20:24:00
106	61	2	2021-10-27	varivax	online	17	2	2021-10-26	08:30:00
107	62	2	2021-10-28	varivax	online	3	2	2021-10-27	09:49:00
108	65	1	2021-10-29	varivax	online	20	2	2021-10-28	04:39:00
109	31	1	2021-10-30	proquad	online	17	2	2021-10-29	10:14:00
110	35	2	2021-10-31	proquad	offline	5	2	2021-10-30	17:22:00

5. Query to view centers in a given city: