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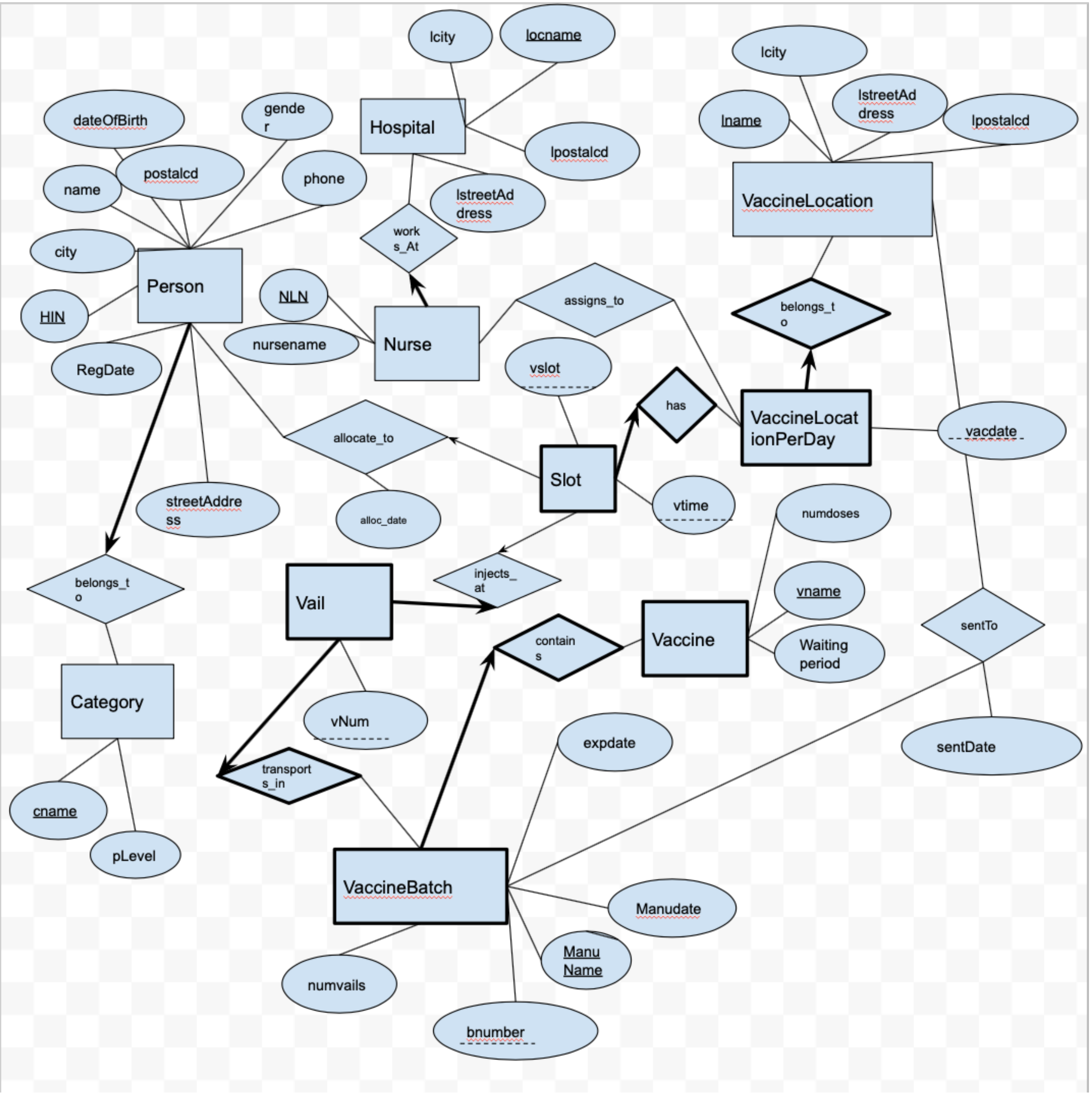
Part I Relational Model

Updated E/R model:



Updated relational model:

Person (<u>HIN</u>, RegDate, city, name, postalcd, phone, streetAddress, gender, cname)

- cname foreign key referencing relation Category

Category (<u>cname</u>, pLevel)

Nurse (<u>NLN</u>, nursename, locname)

- locname foreign key referencing relation Hospital

Hospital (<u>locname</u>, lcity, lpostalcd, lstreetAddress)

VaccineLocation (<u>lname</u>, lcity, lpostalcd, lstreetAddress)

VaccineLocPerDay (vacdate, lname)

- lname foreign key referencing relation VaccineLocation

Slot (vslot, vtime, vacdate, lname)

- (vacdate, lname) foreign key referencing relation VaccineLocPerDay

Vaccine(vname, waitingPeriod, numdoses)

VaccineBatch (numvails, expdate, bnumber, manudate, vname)

- vname foreign key referencing relation Vaccine

Vail (vnum, bnumber, vname, vslot, vtime, vacdate, lname)

- (bnumber, vname) foreign key referencing relation VaccineBatch
- (vslot, vtime, vacdate, lname) foreign key referencing relation Slot

nurseAssignments (NLN, vacdate, lname)

- NLN foreign key referencing relation Nurse
- (vacdate, lname) foreign key referencing relation VaccineLocPerDay

personAllocation (alloc_date, HIN, vslot, vtime, vacdate, lname)

- HIN foreign key referencing relation Person
- (vslot, vtime, vacdate, lname) foreign key referencing relation Slot

batchStorage (bnumber, vname, lname, sentDate)

- (bnumber, vname) foreign key referencing relation VaccineBatch
- lname foreign key referencing relation VaccineLocation

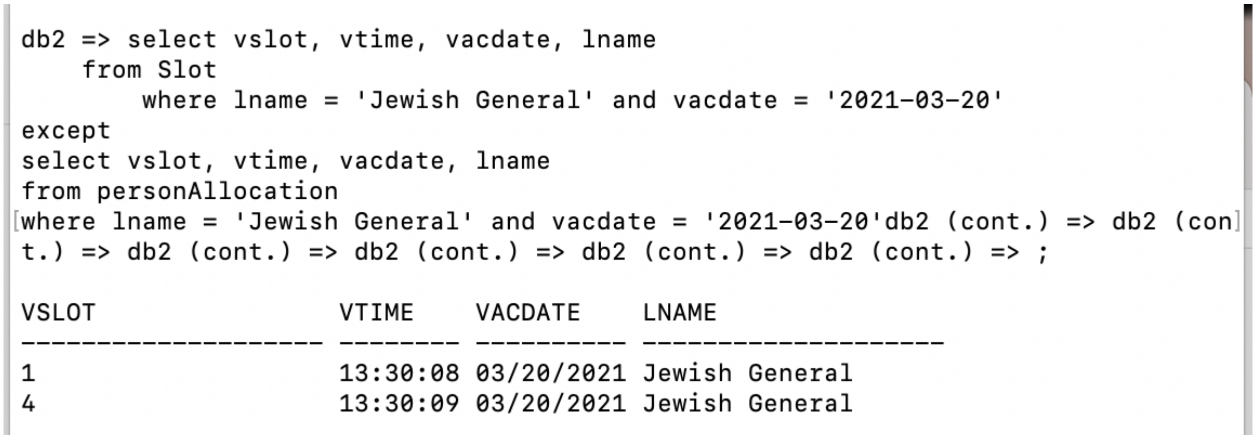
Part II Pending constraints

- When assign a person a category, we have to manually check the category stored is the one with highest priority (pLevel) if a person belongs to several categories
- When a slot is created at a VaccineLocPerDay, the personAllocation must be created based on the pLevel for the category that cname is associated with the person (connected to personAllocation by HIN)
- We have to manually make sure that when a vail injection is created, at least one nurse assignment must exist for the vaccineLocPerDay associated with the slot where the injection happened.
- We have to manually check that the sentDate in batchStorage must be before the vail injection slot date and time that the vails inside each VaccineBatch is injected
- We have to check that the number of vail relations for each VaccineBatch must be less that the numvails attributes in this VaccineBatch
- For the personAllocation relation for each person, if there are more than one slot associated with him/her, the vail injection happened at these slots must belong to same vaccine name, which can be acquired by VaccineBatch relation, and must be less that the numdoses for that vaccine. Additionally, the vacdate difference between these slots must be greater than the waitingPeriod for the vaccine.
- For each vail injection, the date of the slot associated with it must before the expdate of the vaccineBatch associated with it.
- The vail can only be created if the personAllocation for the slot associated with the vail is not null.
- The database system does not prevent 2 people choosing the same slot, which should not be allowed in reality.

- Assume that the person is successfully injected once personAllocation is created (there cannot be invalid personAllocation); the instance of personAllocation has to deleted from database if a person wants to cancel the appointment
- The regDate for each person must be before the data and time for the slot that is associated with the personAllocation for that person (can be accessed by the HIN for a given person)
- For each slot associated with a given vail injection, the number of personAllocation associated with the vaccineLocPerDay that is associated with the slot must be less than or equal to the number of nurse assignments associated with that vaccineLocPerDay.

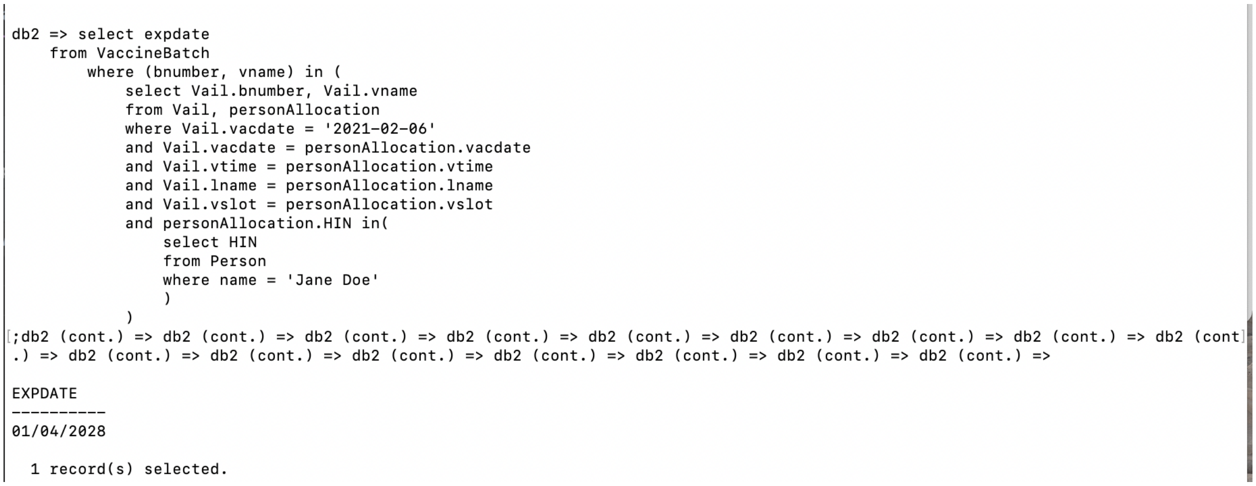
Part III SQL Queries

a)
```
select vslot, vtime, vacdate, lname
from Slot
where lname = 'Jewish General' and vacdate = '2021-03-20'
except
select vslot, vtime, vacdate, lname
from personAllocation
where lname = 'Jewish General' and vacdate = '2021-03-20'
;
```



```
db2 => select vslot, vtime, vacdate, lname
    from Slot
        where lname = 'Jewish General' and vacdate = '2021-03-20'
except
select vslot, vtime, vacdate, lname
from personAllocation
where lname = 'Jewish General' and vacdate = '2021-03-20'db2 (cont.) => db2 (con
t.) => db2 (cont.) => db2 (cont.) => db2 (cont.) => db2 (cont.) => ;

VSLOT                VTIME    VACDATE    LNAME
-------------------- -------- ---------- --------------------
1                    13:30:08 03/20/2021 Jewish General
4                    13:30:09 03/20/2021 Jewish General
```

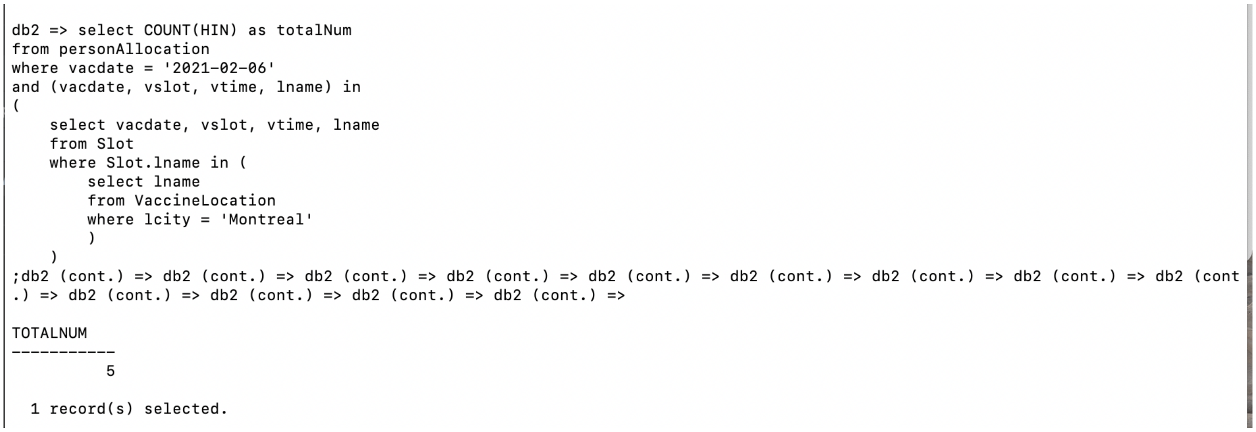
b)
```
select expdate
    from VaccineBatch
        where (bnumber, vname) in (
            select Vail.bnumber, Vail.vname
            from Vail, personAllocation
            where Vail.vacdate = '2021-02-06'
            and Vail.vacdate = personAllocation.vacdate
            and Vail.vtime = personAllocation.vtime
            and Vail.lname = personAllocation.lname
            and Vail.vslot = personAllocation.vslot
            and personAllocation.HIN in(
                select HIN
                from Person
                where name = 'Jane Doe'
                )
        )
;
```



```
db2 => select expdate
    from VaccineBatch
        where (bnumber, vname) in (
            select Vail.bnumber, Vail.vname
            from Vail, personAllocation
            where Vail.vacdate = '2021-02-06'
            and Vail.vacdate = personAllocation.vacdate
            and Vail.vtime = personAllocation.vtime
            and Vail.lname = personAllocation.lname
            and Vail.vslot = personAllocation.vslot
            and personAllocation.HIN in(
                select HIN
                from Person
                where name = 'Jane Doe'
                )
            )
;db2 (cont.) => db2 (cont.) => db2 (cont.) => db2 (cont.) => db2 (cont.) => db2 (cont.) => db2 (cont.) => db2 (cont.) => db2 (cont
.) => db2 (cont.) => db2 (cont.) => db2 (cont.) => db2 (cont.) => db2 (cont.) => db2 (cont.) => db2 (cont.) =>

EXPDATE
----------
01/04/2028

  1 record(s) selected.
```

c)

```
select COUNT(HIN) as totalNum
from personAllocation
where vacdate = '2021-02-06'
and (vacdate, vslot, vtime, lname) in
(
   select vacdate, vslot, vtime, lname
   from Slot
   where Slot.lname in (
      select lname
      from VaccineLocation
      where lcity = 'Montreal'
      )
   )
;
```

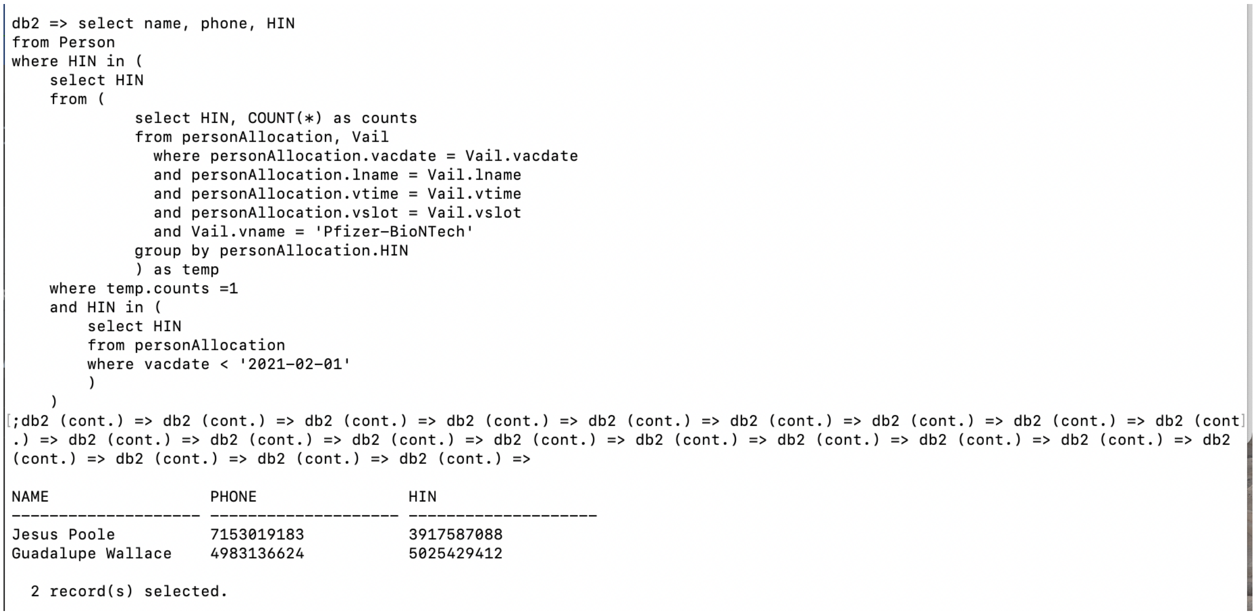


```
db2 => select COUNT(HIN) as totalNum
from personAllocation
where vacdate = '2021-02-06'
and (vacdate, vslot, vtime, lname) in
(
    select vacdate, vslot, vtime, lname
    from Slot
    where Slot.lname in (
        select lname
        from VaccineLocation
        where lcity = 'Montreal'
        )
    )
;db2 (cont.) => db2 (cont.) => db2 (cont.) => db2 (cont.) => db2 (cont.) => db2 (cont.) => db2 (cont.) => db2 (cont.) => db2 (cont
.) => db2 (cont.) => db2 (cont.) => db2 (cont.) => db2 (cont.) =>

TOTALNUM
-----------
          5

  1 record(s) selected.
```

d)

```
select name, phone, HIN
from Person
where HIN in (
   select HIN
   from (
          select HIN, COUNT(*) as counts
```

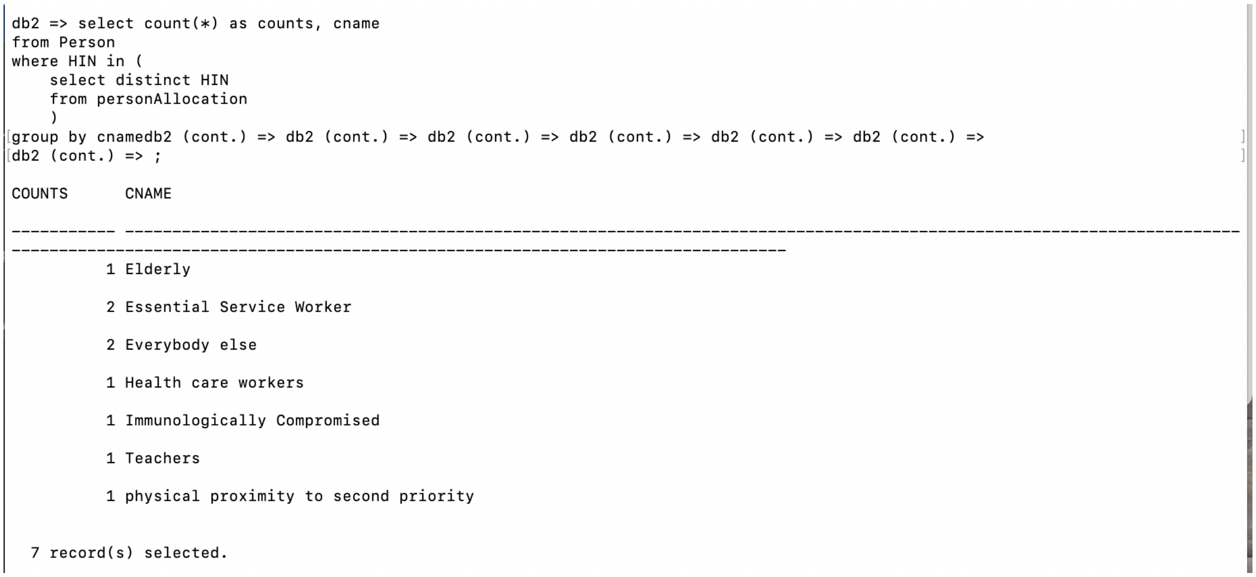
```
            from personAllocation, Vail
              where personAllocation.vacdate = Vail.vacdate
              and personAllocation.lname = Vail.lname
              and personAllocation.vtime = Vail.vtime
              and personAllocation.vslot = Vail.vslot
              and Vail.vname = 'Pfizer-BioNTech'
            group by personAllocation.HIN
            ) as temp
    where temp.counts =1
    and HIN in (
        select HIN
        from personAllocation
        where vacdate < '2021-02-01'
        )
    )
;
```



```
db2 => select name, phone, HIN
from Person
where HIN in (
    select HIN
    from (
             select HIN, COUNT(*) as counts
             from personAllocation, Vail
               where personAllocation.vacdate = Vail.vacdate
               and personAllocation.lname = Vail.lname
               and personAllocation.vtime = Vail.vtime
               and personAllocation.vslot = Vail.vslot
               and Vail.vname = 'Pfizer-BioNTech'
             group by personAllocation.HIN
             ) as temp
    where temp.counts =1
    and HIN in (
        select HIN
        from personAllocation
        where vacdate < '2021-02-01'
        )
    )
[;db2 (cont.) => db2 (cont.) => db2 (cont.) => db2 (cont.) => db2 (cont.) => db2 (cont.) => db2 (cont.) => db2 (cont.) => db2 (cont]
.) => db2 (cont.) => db2 (cont.) => db2 (cont.) => db2 (cont.) => db2 (cont.) => db2 (cont.) => db2 (cont.) => db2 (cont.) => db2
(cont.) => db2 (cont.) => db2 (cont.) => db2 (cont.) =>

NAME                 PHONE                HIN
-------------------- -------------------- --------------------
Jesus Poole          7153019183           3917587088
Guadalupe Wallace    4983136624           5025429412

  2 record(s) selected.
```

e) select count(*) as counts, cname

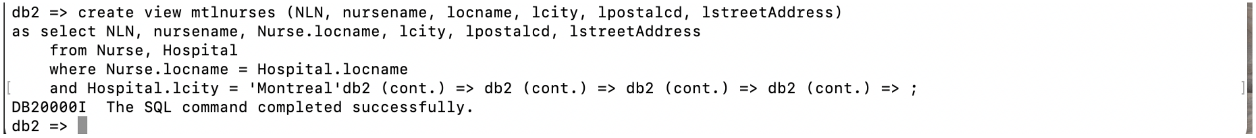
```
from Person
where HIN in (
    select distinct HIN
    from personAllocation
    )
group by cname
;
```



```
db2 => select count(*) as counts, cname
from Person
where HIN in (
    select distinct HIN
    from personAllocation
    )
group by cnamedb2 (cont.) => db2 (cont.) => db2 (cont.) => db2 (cont.) => db2 (cont.) => db2 (cont.) =>
db2 (cont.) => ;

COUNTS      CNAME

----------- ----------------------------------------------------------------------------------------------------------------------
----------------------------------------------------------------------------------
          1 Elderly

          2 Essential Service Worker

          2 Everybody else

          1 Health care workers

          1 Immunologically Compromised

          1 Teachers

          1 physical proximity to second priority


  7 record(s) selected.
```

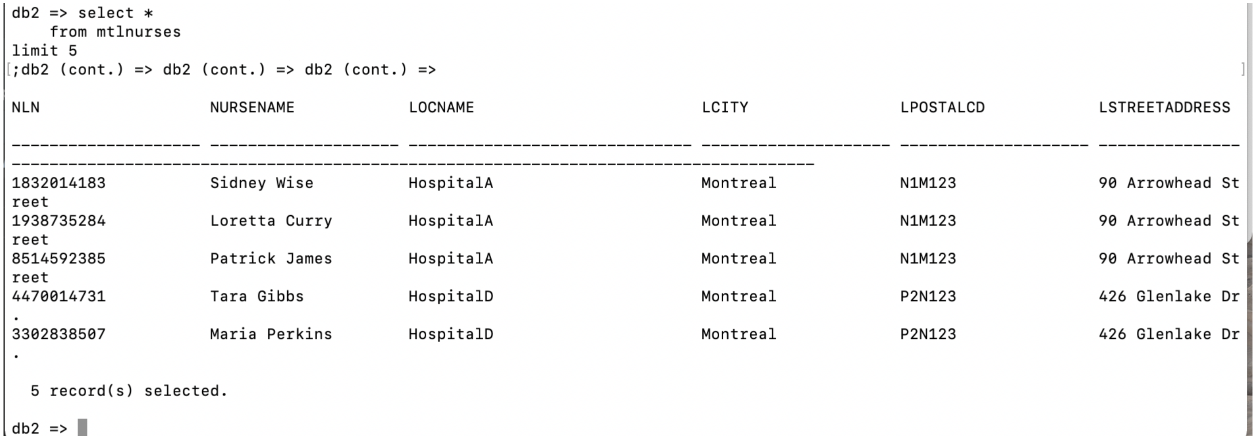
Part IV Montreal Nurses

- View definition:
  create view mtlnurses (NLN, nursename, locname, lcity, lpostalcd, lstreetAddress)
  as select NLN, nursename, Nurse.locname, lcity, lpostalcd, lstreetAddress
     from Nurse, Hospital
     where Nurse.locname = Hospital.locname
     and Hospital.lcity = 'Montreal'
  ;
- Screenshot of successfully created view



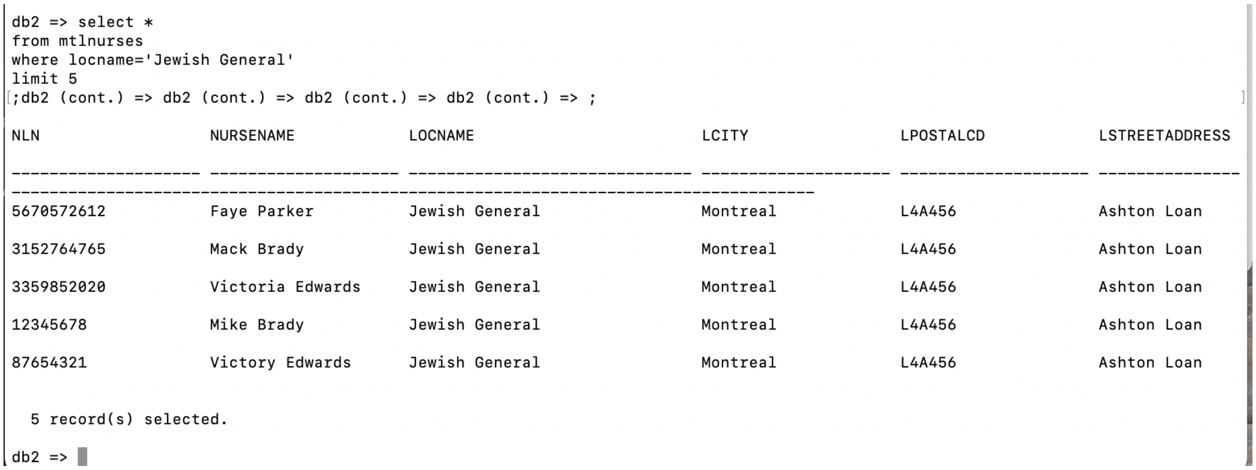
```
db2 => create view mtlnurses (NLN, nursename, locname, lcity, lpostalcd, lstreetAddress)
as select NLN, nursename, Nurse.locname, lcity, lpostalcd, lstreetAddress
    from Nurse, Hospital
    where Nurse.locname = Hospital.locname
    and Hospital.lcity = 'Montreal'db2 (cont.) => db2 (cont.) => db2 (cont.) => db2 (cont.) => ;
DB20000I  The SQL command completed successfully.
db2 =>
```

-
- Screenshot of selecting 5 records from view



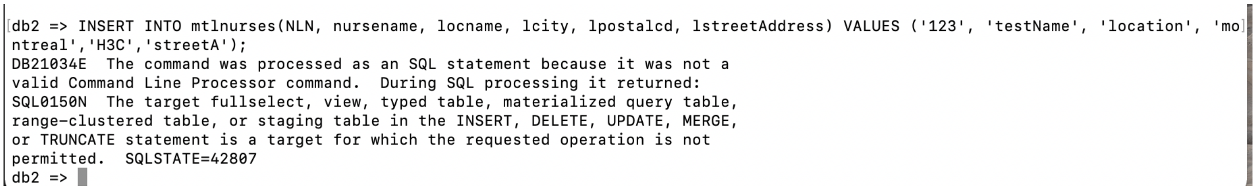
```
db2 => select *
    from mtlnurses
limit 5
;db2 (cont.) => db2 (cont.) => db2 (cont.) =>

NLN                  NURSENAME            LOCNAME                        LCITY                LPOSTALCD            LSTREETADDRESS

-------------------- -------------------- ------------------------------ -------------------- -------------------- --------------
-------------------------------------------------------------------------------------
1832014183           Sidney Wise          HospitalA                      Montreal             N1M123               90 Arrowhead St
reet
1938735284           Loretta Curry        HospitalA                      Montreal             N1M123               90 Arrowhead St
reet
8514592385           Patrick James        HospitalA                      Montreal             N1M123               90 Arrowhead St
reet
4470014731           Tara Gibbs           HospitalD                      Montreal             P2N123               426 Glenlake Dr
.
3302838507           Maria Perkins        HospitalD                      Montreal             P2N123               426 Glenlake Dr
.

  5 record(s) selected.

db2 =>
```

-
- Screenshot of selecting 5 records from nurses that are employed at “Jewish General”



```
db2 => select *
from mtlnurses
where locname='Jewish General'
limit 5
;db2 (cont.) => db2 (cont.) => db2 (cont.) => db2 (cont.) => ;

NLN                  NURSENAME            LOCNAME                        LCITY                LPOSTALCD            LSTREETADDRESS

-------------------- -------------------- ------------------------------ -------------------- -------------------- ---------------
-------------------------------------------------------------------------------------
5670572612           Faye Parker          Jewish General                 Montreal             L4A456               Ashton Loan

3152764765           Mack Brady           Jewish General                 Montreal             L4A456               Ashton Loan

3359852020           Victoria Edwards     Jewish General                 Montreal             L4A456               Ashton Loan

12345678             Mike Brady           Jewish General                 Montreal             L4A456               Ashton Loan

87654321             Victory Edwards      Jewish General                 Montreal             L4A456               Ashton Loan


  5 record(s) selected.

db2 =>
```

- Screenshot of the insert command



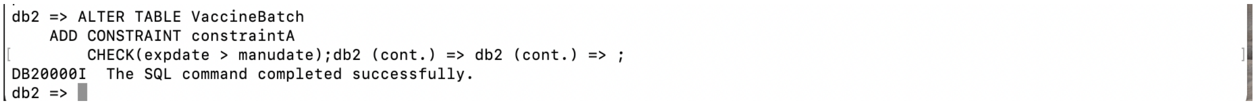
```
db2 => INSERT INTO mtlnurses(NLN, nursename, locname, lcity, lpostalcd, lstreetAddress) VALUES ('123', 'testName', 'location', 'mo
ntreal','H3C','streetA');
DB21034E  The command was processed as an SQL statement because it was not a
valid Command Line Processor command.  During SQL processing it returned:
SQL0150N  The target fullselect, view, typed table, materialized query table,
range-clustered table, or staging table in the INSERT, DELETE, UPDATE, MERGE,
or TRUNCATE statement is a target for which the requested operation is not
permitted.  SQLSTATE=42807
db2 =>
```

- Explanation:

  As shown above, the insert cannot be successfully executed. It is because the view we created is not a valid table. The view is just created for our convenience to get certain combinations of data in database. It is not created to store data, instead, it is created based on “actual” table in database, therefore, we cannot perform “insert” operation on a view.

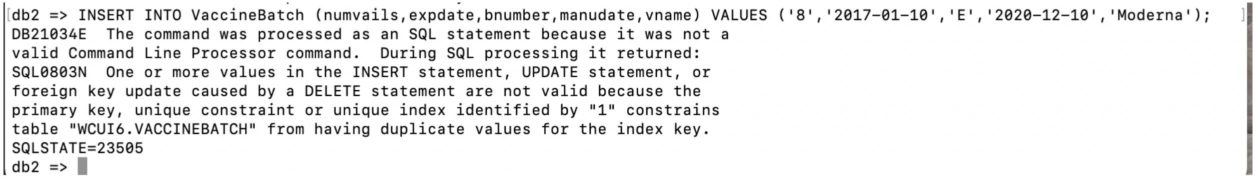
Part V: Check Constraints

- Screenshot of the check constraint



```
db2 => ALTER TABLE VaccineBatch
    ADD CONSTRAINT constraintA
        CHECK(expdate > manudate);db2 (cont.) => db2 (cont.) => ;
DB20000I  The SQL command completed successfully.
db2 =>
```

- Attempt to insert an invalid record



```
db2 => INSERT INTO VaccineBatch (numvails,expdate,bnumber,manudate,vname) VALUES ('8','2017-01-10','E','2020-12-10','Moderna');
DB21034E  The command was processed as an SQL statement because it was not a
valid Command Line Processor command.  During SQL processing it returned:
SQL0803N  One or more values in the INSERT statement, UPDATE statement, or
foreign key update caused by a DELETE statement are not valid because the
primary key, unique constraint or unique index identified by "1" constrains
table "WCUI6.VACCINEBATCH" from having duplicate values for the index key.
SQLSTATE=23505
db2 =>
```

It is a failure because it violates the constraint that the expdate of a VaccineBatch must be past its manudate.