

Database Design to Streamline COVID-19 Vaccination Methods in Virginia

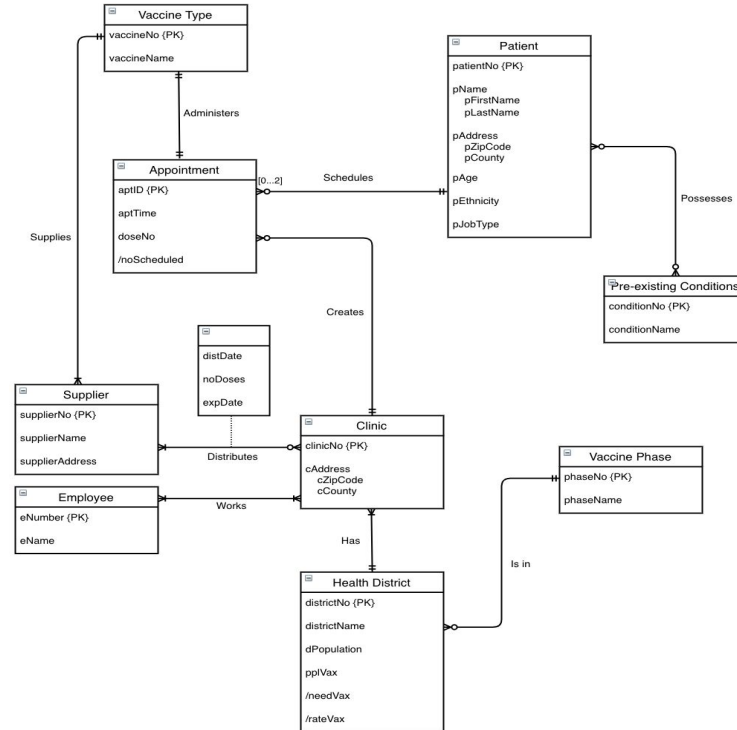
Overview of Project

Problem: Vaccines are not distributed in a logical manner, resulting in wasted vaccines and inability to get vaccinated for those with greatest need

Goal of Database: To help VDH make better informed decisions regarding how to efficiently and equitably distribute vaccines.



ERD Design



Relational models and DDL



Relational Model

Patient(patientNo, pFirstName, pLastName, pZipCode, pCounty, pAge, pEthnicity, pJobType)

PreExistingConditions(conditionNo, conditionName)

Possesses(/patientNo././conditionNo/)

Employee(eNumber, eName)

HealthDistrict(districtNo, districtName, dPopulation, phaseNo, pplVax)

Clinic(clinicNo, cZipCode, cCounty, /districtNo/)

Works(/clinicNo, eNumber/)

VaccineType(vaccineNo, vaccineName)

Supplier(supplierNo, supplierName, supplierAddress, /vaccineNo/)

Distributes(/supplierNo././clinicNo./, distDate, noDoses, expDate)

Appointment(aptID, aptTime, doseNo, /vaccineNo/, /patientNo/, /clinicNo/)

DDL

```
CREATE TABLE Distributes (  
    supplierNo CHAR(2) NOT NULL,  
    clinicNo CHAR(2) NOT NULL,  
    distDate DATE,  
    noDoses INT(10),  
    expDate DATE,  
    CONSTRAINT pk_Distributes PRIMARY KEY (supplierNo,  
    clinicNo),  
    CONSTRAINT fk_Distributes_supplierNo FOREIGN KEY  
    (supplierNo) REFERENCES Supplier(supplierNo),  
    CONSTRAINT fk_Distributes_clinicNo FOREIGN KEY (clinicNo)  
    REFERENCES Clinic(clinicNo)  
);
```

DML and Insights

How many days will it take to vaccinate x% of each Health District with one dose?

Highest Daily Average: **Central Virginia**

Lowest Daily Average: **Lord Fairfax**

Shortest time: **Piedmont**

Longest time: **Lord Fairfax**

	districtName	dailyAverage	Population	PeopleVaccinated	notVaxed	daysTilFullVax
	Piedmont	2.0000	103000	18000	84998	42499
	Central Virginia	2.5000	261000	112000	148995	59598
	Blue Ridge	2.0000	250000	71000	178994	89497
▶	Lord Fairfax	0.6667	233000	166000	66998	100497

How to mitigate risk of expired vaccines?

18% of total
doses expire

	aptDate	expDate	clinicNo	administeredDoses	totalDoses	expiredDoses
▶	2021-04-20	2021-04-20	1	2	4	2
	2021-04-20	2021-04-20	6	1	2	1
	2021-04-21	2021-04-21	7	1	7	6

How should the vaccine doses be distributed across the health districts in an equitable manner?

districtNo	LeftToVax
1	179000
2	85000
3	149000
4	67000

PatientsWConditio...	districtNo
1	1
3	1
5	1
6	3
8	3
9	1
11	4
13	1
15	3

PatientsOver...	districtNo	pAge
3	1	59
4	2	76
11	4	75
14	3	81

How does each health district perform compared to the state average in terms of vaccination rates?

State Avg. Weekly Rate:

7%

	districtName	currPropVax	needVax	schedVax	vaxRate
►	Blue Ridge	0.2840	179000	15000	0.0838
	Piedmont	0.1748	85000	5000	0.0588
	Central Virginia	0.4291	149000	12500	0.0839
	Lord Fairfax	0.7124	67000	5000	0.0746

On a given day, which clinics are expected to have unused vaccines and how many?

Most Available:
Clinic 7 on 4/20

	distDate	clinicNo	totalDoses	aptMade	aptAvail
▶	2021-04-19	1	4	3	1
	2021-04-19	6	2	1	1
	2021-04-20	7	7	1	6
	2021-04-21	3	2	1	1
	2021-04-22	3	2	1	1
	2021-04-23	4	6	3	3
	2021-04-24	5	3	1	2

Best Place for J&J:
Lord Fairfax

	districtName	vaccineName	doseProp
▶	Blue Ridge	Pfizer	1.0000
	Piedmont	Pfizer	0.5000
	Piedmont	Moderna	0.5000
	Central Virginia	Pfizer	0.5000
	Central Virginia	Moderna	0.4286
	Central Virginia	Johnson & Johnson	0.0714
	Lord Fairfax	Johnson & Johnson	0.3636
	Lord Fairfax	Moderna	0.6364

Is the lack of vaccines or lack of employees at clinics the reason why people are not being vaccinated?

	clinicNo	distDate	noDoses	noAppointmen...	NoEmployees
▶	1	2021-04-19	4	3	2
	2	2021-04-20	3	3	1
	3	2021-04-21	2	2	2
	3	2021-04-22	2	2	2
	4	2021-04-23	6	3	3
	5	2021-04-24	3	1	3
	5	2021-04-25	7	1	3
	6	2021-04-19	2	1	2
	6	2021-04-22	5	1	2
	6	2021-04-23	5	1	2
	7	2021-04-20	7	1	1
	8	2021-04-21	4	1	2

Takeaways

- 1 Factors beyond population size should be considered
 - ▷ Pre-existing conditions, age
- 2 Monitoring performance by clinic and health district can guide decisions regarding opening new clinics and reallocating doses
- 3 Our design provides a more streamlined way to find last-minute available appointments
- 4 Our design can be applied to future vaccine rollouts