

Final Report Project for a Vaccine Recording System

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Problem Description

The Emergency Department (ED) offers and administers vaccines routinely to their admitted patients according to the immunization's protocols (i.e. vaccination schedule, seasonal disease, boosters, etc.). Vaccinations are charted in paper and records are physically stored in the hospital's records room. Those paper-based records not only do they take up on limited space but are only accessible by the hospital's administration. The hospital recognized the limitations of this workflow and identified an opportunity to improve their recording system.

Solution Approach

ED management and HIT department decided that a computer-based Vaccine Recording System (VRS) could help improve workflows, facilitate vaccine traceability, and reduce the amount of paperwork at the ED. This VRS consist of an MS Access database that generates a unique record entry per vaccine administered. The team designed an entity-relationship diagram (see Appendix A) with the entity 'Record' is the center piece of the VRS. A Record form is available upon opening the database to facilitate the recording of new vaccination instances. Each entry requires entering the patient's last and first names, and date of birth, type of vaccine, clinician that administers the vaccine and the provider that prescribes it. The date of administration (Vaccination Date) automatically populates to date, but clinicians can enter a different date in the past. The most common questions to be answered by this VRS are established as pre-programmed queries. Multiple reports and additional forms are available to the users to make the database more usable and meaningful.

Limitations

The database created to keep record of vaccines administered to patients in the ED have several limitations. The database is limited to track the vaccines administered to patients that were only vaccinated through the ED. Any other patient history or previous vaccination records were not included. As a result, it is difficult to track other vaccinations administer outside

the hospital. The database management system of choice does not allow multi-user sessions, so data needs to be entered one user at a time. Another limitation impacts on cases where patients receive more than one vaccine in one single visit to the ED. Since each vaccination instance will create a new entry in the Record table, users will have to create as many entries as vaccines have been administered to one patient during that visit.

Future Extensions

Physical database design is essential as it influences factors that are important to the end-users. First, extensions to the database could address the limitations described in this paper, including tracking the vaccines administered only through the hospital's ED and excluding the history of the patient's vaccination records. Ideally, future extensions should focus on managing data with different levels of transparency, increased reliability and availability, and easier expansion. Currently, vaccine records are stored in a paper-based recording system in a hospital records room. In the future, a database tool such as a VRS could help the hospital staff access the vaccine records when needed promptly. The extensions to the database could be merged with electronic medical records for employees flexibility and increased workflow. In addition, future extension could include adding adverse reaction's information for safety. Lastly, a future extension could encompass prioritizing alerts and providing enhanced analysis of the patient's vaccine records.

Lessons Learned

The group goal was to create a database that would adequately record the vaccine administration of patients in the emergency department. Creating a database is a process that cannot be developed without dedicating time and have careful consideration for overall function and layout. This project required each person's collaboration and scheduling adaptability to continue to ensure developmental progress. There were iterations of the database that we noticed the relationships and future expandability were an issue. Having a distinct attribute name helped in follow-up reports, queries, and forms, without these distinctions there were

times we could not determine which table the attribute was referencing. Adding sub-forms also was a helpful addition to our project, instead of using multiple forms to update the database, one form was used that provided a better view of vaccines for a specific manufacturer.

Assessment on Outcome vs. Proposal Objectives

The project proposal objectives included documenting patient details and type of vaccine administered in the ED and the system would be able to provide patient vaccination report. The overall objectives were met with the creation of the VRS Access database forms and reports. The question *What are the vaccines that were administered for the past 10 days, list in descending order?* Is answered by the report; “rpt1 - Vaccines Last 10 days”.

MS Access Report

An Access report called “rpt1 - Vaccines Last 10 days” was created for the database query “1 - Vaccines Last 10 days”. This report responds to the question identified in queries, the question *What are the vaccines that were administered for the past 10 days, list in descending order?* applied to two table. The main objective of our group’s original project proposal was to answer, “What are the vaccines that were administered?” we narrowed down the original project objective to a set date range. The report heading “Vaccines Last 10 days”, and the pertinent information can be found in the four columns labeled: Vaccination date, Last Name, First Name, and Vaccine Name. See Appendix C

The primary purpose of the report was to understand how many patients visited the hospital and what type of vaccine patients received; this enabled the hospital to accommodate adequate staff and vaccine levels. By preparing with adequate staffing and vaccine stock, hospitals can produce a contingency plan for any pandemic or vaccine requirements for patients. In one example, due to the lack of a contingency plan, in our hospital patients had to wait over three hours for just a covid shot resulting in some patients being escorted to the emergency room for near syncope episodes and hypoglycemia.

Queries

1. What are the vaccines that were administered for the past 10 days, list in descending order?
 - a. Access query is named: "1 - Vaccines Last 10 days"
2. Which patient has taken more than two vaccines?
 - a. Access query is named: "2 - Patient <2 Vaccines"
3. How many vaccines on the current day have been administered by an RN?
 - a. Access query is named: "3 - Vaccines by RN Today"
4. How many different vaccines were ordered by MDs?
 - a. Access query is named: "4 - MD ordered vaccines"
5. What are the genders of the patients who received Moderna?
 - a. Access query is named: "5 - Moderna - Patients' Genders"

Complex question

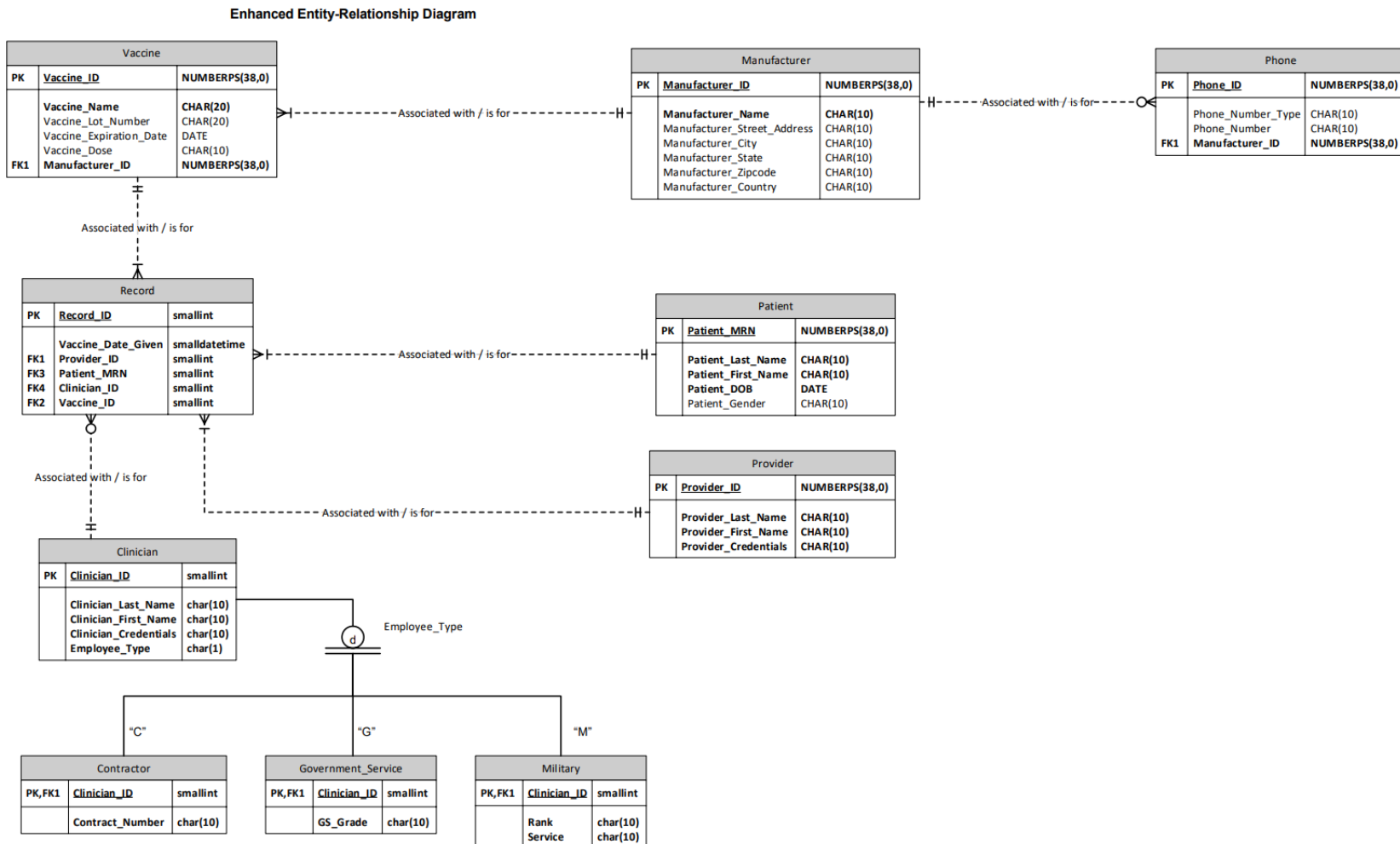
Question: What is the name of the patients that are vaccinated by government employees along with the vaccine type administered by a government employee in the past 10 days?

The Access query is named "Complex - Patient Vaccinated by GS" This query processes the tables of Clinician, Record, Patient and Vaccine.

Appendix A

Figure 1

Enhanced Entity-Relationship Diagram



Appendix C

Figure 2

Vaccines in Last 10 Days

Vaccines Last 10 days

Vaccination Date	Last Name	First Name	Vaccine Name
4/20/2021	Shostakov	Alexei	Fluarix (trivalent)
4/20/2021	Shostakov	Alexei	Diphtheria and Tetanus Toxoids Adsorbed
4/20/2021	Quill	Peter	Adacel
4/20/2021	Pym	Hope	DIPROLENE
4/17/2021	Peter	Parker	YF-VAX
4/15/2021	Maximoff	Wanda	Cervarix
4/13/2021	Rogers	Steve	Imogam
4/13/2021	Pym	Hope	Bexsero
4/13/2021	Carter	Sharon	Boostrix

Friday, April 23, 2021

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Appendix D

Structured Query Language Code for Queries

1. Vaccines Last 10 days

```
SELECT Record.Vaccine_ID, Record.Vaccine_Date_Given
FROM Record
GROUP BY Record.Vaccine_ID, Record.Vaccine_Date_Given
HAVING (((Record.Vaccine_Date_Given) Between Date() And DateAdd("d",-10,Date())))
ORDER BY Record.Vaccine_Date_Given DESC;
```

2. Patient <2 Vaccines

```
SELECT Patient.Patient_Last_Name, Patient.Patient_First_Name, Patient.Patient_DOB,
Patient.Patient_Gender
```



```
FROM Patient INNER JOIN Record ON Patient.Patient_MRN = Record.Patient_MRN  
GROUP BY Record.Patient_MRN, Patient.Patient_Last_Name, Patient.Patient_First_Name,  
Patient.Patient_DOB, Patient.Patient_Gender  
HAVING (((Count(Record.Patient_MRN))>2));
```

3. Vaccines by RN Today

```
SELECT Clinician.Clinician_Last_Name, Clinician.Clinician_Credentials,  
Record.Vaccine_Date_Given  
FROM Clinician INNER JOIN Record ON Clinician.Clinician_ID = Record.Clinician_ID  
WHERE (((Clinician.Clinician_Credentials)="Registered Nurse") AND  
((Record.Vaccine_Date_Given)=Date()));
```

4. MD ordered vaccines.

```
SELECT Provider.Provider_Last_Name, Provider.Provider_Credentials, Record.Vaccine_ID,  
Count(Record.Vaccine_ID) AS CountOfVaccine_ID  
FROM Provider INNER JOIN Record ON Provider.Provider_ID = Record.Provider_ID  
GROUP BY Provider.Provider_Last_Name, Provider.Provider_Credentials,  
Record.Vaccine_ID  
HAVING (((Provider.Provider_Credentials)="MD"));
```

5. Moderna - Patients' Genders

```
SELECT Manufacturer.Manufacturer_Name, Vaccine.Vaccine_Name,  
Patient.Patient_Gender  
FROM Manufacturer INNER JOIN (Vaccine INNER JOIN (Patient INNER JOIN Record ON  
Patient.Patient_MRN = Record.Patient_MRN) ON Vaccine.Vaccine_ID =  
Record.Vaccine_ID) ON Manufacturer.Manufacturer_ID = Vaccine.Manufacturer_ID
```

```
WHERE (((Manufacturer.Manufacturer_Name)="Moderna"));
```

Complex - Patient Vaccinated by GS

```
SELECT Patient.Patient_Last_Name, Clinician.Employee_Type, Vaccine.Vaccine_Name,  
Record.Record_ID  
FROM Vaccine INNER JOIN (Patient INNER JOIN (Clinician INNER JOIN Record ON  
Clinician.Clinician_ID = Record.Clinician_ID) ON Patient.Patient_MRN =  
Record.Patient_MRN) ON Vaccine.Vaccine_ID = Record.Vaccine_ID  
WHERE (((Clinician.Employee_Type)="G"))  
GROUP BY Patient.Patient_Last_Name, Clinician.Employee_Type,  
Vaccine.Vaccine_Name, Record.Record_ID, Record.Vaccine_ID,  
Record.Vaccine_Date_Given  
HAVING (((Record.Vaccine_Date_Given) Between Date() And DateAdd("d",-10,Date())))  
ORDER BY Record.Vaccine_Date_Given DESC;
```