CU Boulder, M.S. in Data Science
Relational Database Design Final Project

Business Background:

My client, a healthcare company called Primary Care CA owns 20 primary care clinics and has been serving the San Diego area for 15 years. Primary Care CA provides primary and preventative care services for pediatric, adult, and geriatric patients. The healthcare company has hired me to create a Relational Database Management System as their current filing system is outdated and disorganized and is not adept to handle the data of their growing business. Primary Care CA is most concerned with recording data related to their patients, providers, clinics, and appointments. It is important for the company to understand the relationships between these four entities as they are at the core of their primary care business.

Summary of the Entities:

Patients: MedicalRecord#, FirstName, LastName, DoB, Age, Address, Phone#, Sex, InsurancePolicy#, InsuranceName

- MedicalRecord# is the identifier

Providers: ProviderNPI, FirstName, LastName, ProviderType

- Provider NPI is the identifier

Clinics: ClinicID, ClinicName, StreetAddress, City, State, ZipCode, Phone#

- ClinicID is the identifier

Appointments: Appointment#, AppointmentDate, AppointmentTime, MedicalRecord#, ProviderNPI, ClinicID, Status

- Appointment# is the identifier

Relationships between the entities (ER Model):

· A patient may have one or more (zero or more) appointments; and each appointment must belong to one and only one patient.

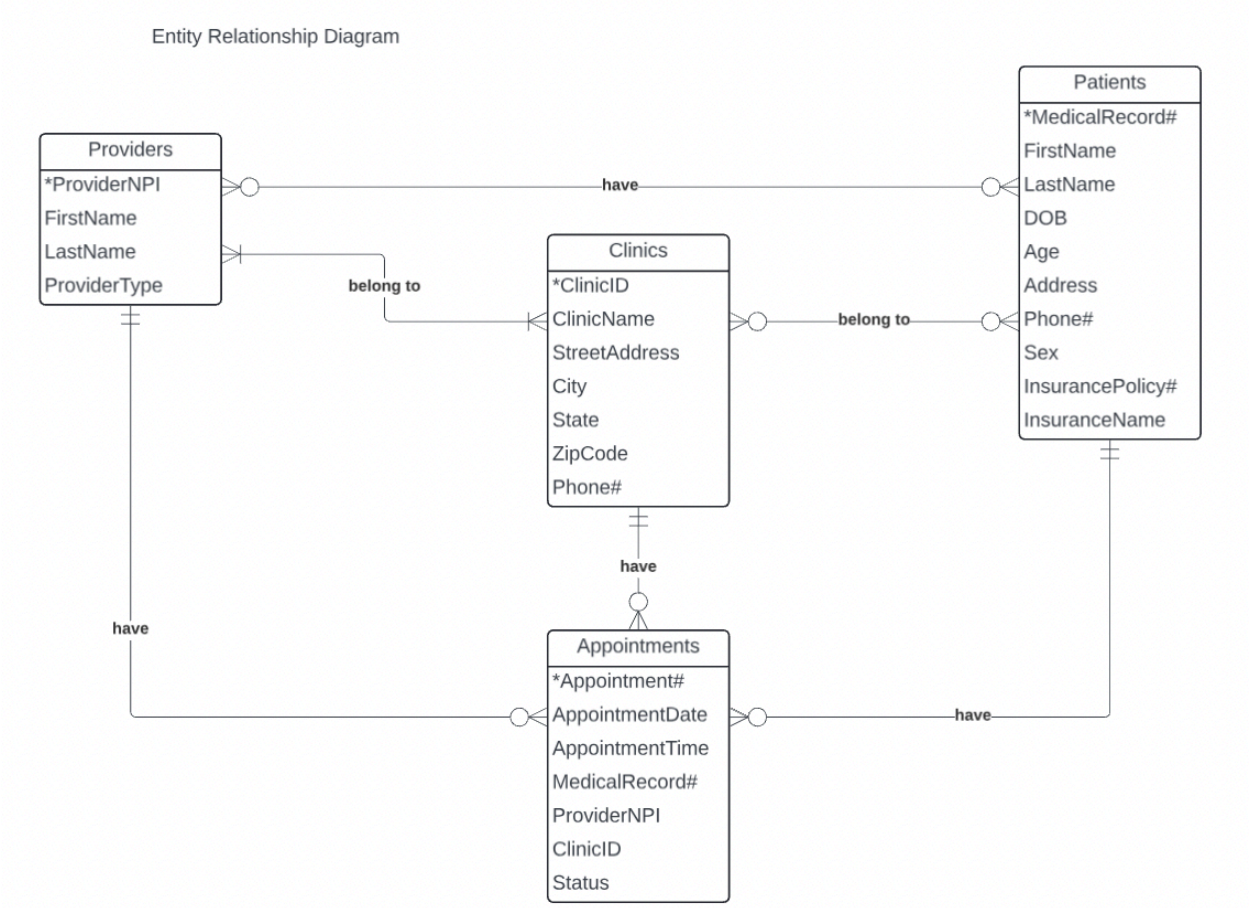
· A provider may treat one or more patients (zero or more); and a patient may be treated by one or more (zero or more) providers.

· A provider must belong to one or more clinics; and a clinic must have one or more providers.

· A patient may belong to one or more clinics; and a clinic may see one or more patients.

· A provider may have one or more appointments; and an appointment must belong to one and only one provider.
· A clinic may have one or more appointments; and an appointment must belong to one and only one clinic.

Created the ERD:



Relational Model Converted from the ERD
***I created notes with an asterisk to make it easier to follow**

Patients(MedicalRecord#, FirstName, LastName, DoB, Age, Address, Phone#, Sex, InsurancePolicy#, InsuranceName)
FD1: MedicalRecord# → FirstName, LastName, DoB, Age, Address, Phone#, Sex, InsurancePolicy#, InsuranceName ***fully FD on primary key**
FD2: InsurancePolicy# → InsuranceName ***this is a transitive functional dependency**
FD3: DoB → Age ***this is transitive FD**

Providers(ProviderNPI, FirstName, LastName, ProviderType)
FD1: ProviderNPI → FirstName, LastName, ProviderType ***fully FD on primary key**

Providers_Clinics(ProviderNPI(fk), ClinicID(fk)) ***Created new relation**

Clinics(ClinicID, ClinicName, Street Address, City, State, ZipCode, Phone#)
FD1: ClinicID → ClinicName, Street Address, City, State, ZipCode, Phone#) ***fully FD on primary key**
FD2: ZipCode → City, State ***this is transitive FD**

Clinics_Patients(ClinicID(fk), MedicalRecord#(fk)) ***Created new relation**

Appointments(Appointment#, AppointmentDate, AppointmentTime, MedicalRecord#(fk), ProviderNPI(fk), ClinicID(fk), Status)
FD1: Appointment# → AppointmentDate, AppointmentTime, MedicalRecord#, ProviderNPI, ClinicID, Status ***fully FD on primary key**

Providers_Patients(ProviderNPI(fk), MedicalRecord#(fk)) ***Created new relation**

Normalize the Relational Model:
Patients(MedicalRecord#, FirstName, LastName, DoB(fk), Address, Phone#, Sex, InsurancePolicy#(fk))
FD1: MedicalRecord# → FirstName, LastName, DoB, Address, Phone#, Sex, InsurancePolicy#
***fully FD on primary key**

Insurance(InsurancePolicy#, InsuranceName) ***created new relation here to remove transitive FD**
FD1: InsurancePolicy# → InsuranceName ***fully FD on primary key**

PatientAge(DoB, Age) ***created new relation here to remove transitive FD**
FD1: DoB → Age ***fully FD on primary key**

Providers(ProviderNPI, FirstName, LastName, ProviderType)
FD1: ProviderNPI → FirstName, LastName, ProviderType ***fully FD on primary key**

Providers_Clinics(ProviderNPI(fk),ClinicID(fk)) ***already in 3NF since no transitive or partial FDs**

Clinics(ClinicID, ClinicName, Street Address, ZipCode(fk), Phone#)
FD1: ClinicID → ClinicName, Street Address, ZipCode, Phone#

ClinicZip(ZipCode, City, State) ***created new relation here to remove transitive FD**
FD1: ZipCode → City, State ***fully FD on primary key**

Clinics_Patients(ClinicID(fk), MedicalRecord#(fk)) ***already in 3NF since no transitive or partial FDs**

Appointments(Appointment#, AppointmentDate, AppointmentTime, MedicalRecord#(fk), ProviderNPI(fk), ClinicID(fk), Status)
FD1: Appointment# → AppointmentDate, AppointmentTime, MedicalRecord#, ProviderNPI, ClinicID, Status ***fully FD on primary key**

Providers_Patients(ProviderNPI(fk), MedicalRecord#(fk)) ***already in 3NF since no transitive or partial FDs**

Final Relational Model in 3NF:
I have removed all the transitive functional dependencies and every non-primary key attribute is fully functionally dependent on the primary key. The last three relations don't have any non-primary key attributes. Now the relational model is normalized in 3NF.

Patients(MedicalRecord#, FirstName, LastName, DoB(fk), Address, Phone#, Sex, InsurancePolicy#(fk))
FD1: MedicalRecord# → FirstName, LastName, DoB, Address, Phone#, Sex, InsurancePolicy#

Insurance(InsurancePolicy#, InsuranceName)
FD1: InsurancePolicy# → InsuranceName

PatientAge(DoB, Age)
FD1: DoB → Age

Providers(ProviderNPI, FirstName, LastName, ProviderType)
FD1: ProviderNPI → FirstName, LastName, ProviderType

Clinics(ClinicID, ClinicName, Street Address, ZipCode(fk), Phone#)
FD1: ClinicID → ClinicName, Street Address, ZipCode, Phone#

ClinicZip(ZipCode, City, State)
FD1: ZipCode → City, State

Appointments(Appointment#, AppointmentDate, AppointmentTime, MedicalRecord#(fk), ProviderNPI(fk), ClinicID(fk), Status)
FD1: Appointment# → AppointmentDate, AppointmentTime, MedicalRecord#, ProviderNPI, ClinicID, Status

Clinics_Patients(ClinicID(fk), MedicalRecord#(fk))

Providers_Patients(ProviderNPI(fk), MedicalRecord#(fk))

Providers_Clinics(ProviderNPI(fk), ClinicID(fk))