Definitions:

Patient

- A patient is an individual who has or is planning to get his or her blood drawn for sampling purposes. A person may have zero or multiple blood samples drawn.

Blood Sample:

- Blood taken from a patient for testing purposes. A blood sample may be tested zero or multiple times.

BloodTest

- A blood test is a test ordered by the patient, which measures the amount of a certain substance in the blood.

Primary Keys:

Patients: Patients can be uniquely identified based solely on email so that could have served as a PK but we ruled it out of candidacy because people's emails can change, hence we created a surrogate key.

Blood Samples: So for a given patient, there could be multiple samples so first we used patient ID's to filter out samples for a given patient. We then used the information given about how a sample can be identified based on time and date to come up with our Primary Key.

Blood Tests: A blood sample may have multiple tests done on it, if the sample hasn't been tested for that substance already. BloodTestType is used to uniquely identify the type of test done on a specific blood sample. The date and time will let us uniquely identify tests from one another if the substance tested is the same. The patient ID lets us identify the person that the sample is ordered for. Therefore all of these are needed for the primary key.

SQL:

```
SELECT PatientName, BloodSampleTime, BloodSampleDate
FROM Patients
INNER JOIN BloodSamples USING(PatientID)
INNER JOIN BloodTests USING(PatientID,BloodSampleDate, BloodSampleTime)
WHERE BloodTestType = 'LDL cholesterol' AND AmountSubstance > 160;
```

Relational Algebra:

π PatientName, BloodSampleTime, BloodSampleDate **σ** BloodTestType = 'LDL cholesterol' and AmountSubstance > 160 (Patients⋈PatientID BloodSamples ⋈BloodSampleDate, BloodSampleTime,PatientID BloodTests)