

Project, Part 1: Design a Model

Assumptions:

Note: Assumptions 1 to 16 are the initial assumptions already given in the assignment handout.

1. A person may parent children with different individuals.
2. Midwives can be assumed to be employed at a single place.
3. Do not worry about “changes”, e.g. - midwives changing employers, retiring, parents switching midwives, clinics, etc.
4. There could be multiple babies involved in a pregnancy.
5. All births in the same pregnancy will happen at the same location. Though the babies themselves are born one after another.
6. Tests are meant only for the mother or the baby.
7. Health care card information, practitioner id, and email are considered unique to an individual, none of the other attributes should be assumed to be unique. You may have to take this into accommodation when designing keys and then potentially add artificial keys. Make sure to include a note in the project.pdf listing all the artificial keys.
8. Although it is possible that blood types of an individual might change in extreme circumstances, we will assume that it remains the same.
9. In reality midwives will have to transfer care to a hospital if the pregnancy is determined to be medically complicated making natural birth risky. We will ignore this aspect.
10. A midwife can be primary for one pregnancy and a backup for another (i.e. every midwife is capable of either roles).
11. For the purposes of home birth, “birth location” is considered as the address of the mother.
12. There could be more than one info session running at the same schedule.
13. A couple could also end up attending more than one information session, but they should attend at least one before they are assigned a midwife.
14. We do not have to store any other information that pertains only to the lab tech (as to who employs them, etc.). Only what is required to connect them to the given requirements.
15. The system should be able to keep track of components from different pregnancies, etc., properly and not just rely on “time” attributes. For example, was that dating ultrasound from the first pregnancy or the second one?
16. Make sure you do not miss any associations (direct or indirect) between the data - e.g. “who wrote this note and who are the concerned parents?”

17. "Institution" is a global term used for Community Centers, Birthing Clinics, Hospitals, etc.
18. We'll assume that if a Couple has twins, triplets, etc. that all names are unique and can't be the same. (Ex: If a couple has two male twins, they both can't be named Michael)
19. A Couple does not mean that the two participants in the couple are married, but rather just they are just the biological parents of the baby of that specific pregnancy.
20. If a miscarriage happens, the number of pregnancies should still be incremented for the both the couple and the mother.
21. It was deemed irrelevant to keep track of the number of pregnancies the BiologicalDad as pregnancies and the number of pregnancies does not affect a man nearly as much as a woman. A Couple's number of pregnancies are indeed counted.
22. Labname is assumed to be unique for all labs, if not, we can create a composite key with both LabName and LabAddress which would quickly fix this issue.
23. InstName is assumed to be unique for all Institutions.

Restrictions/Notes:

1. An Institution assigns parents to both a Midwife and an Information Session. No one else can do this.
2. Each parent may have common attributes, and some may even be duplicates if they are an actual couple or are married. For example, a married couple may have the same phone number, address, etc. This was deemed a better alternative than storing attributes such as phone number and address in Couples, given that a Couple could be divorced or separated and therefore not have the same address and/or phone number.
3. An ISA is used for both BiologicalMom and BiologicalDad, because at face value, they have the same functionality. However, the BiologicalMom entity is much more important in this system.
4. It was difficult to model the status of a Couple and whether or not they were invited, attended, registered in an OnlineInfoSession. Therefore, IsInvited, IsRegistered, and HasAttended are all Boolean attributes that keep track of this information. HasAttended and IsRegistered are attributes of the relationship Attends while IsInvited is a relationship of a Couple. However, an issue may arise from using Boolean attributes: if a couple has already gone through a pregnancy, all these Boolean attributes may be already be set to true even when they have a second pregnancy or third, fourth, etc. Therefore, we would have to reset them to false for every time a couple is pregnant once more.
5. One of the Community Center or the BirthingClinic attributes will be null for the midwife since a Midwife is associated to either one or the other. Furthermore, although Midwife is associated to an Institution by the Assigns relationship, it felt necessary to also have Community Center and Birthing Clinic as an attribute of a Midwife. This will introduce redundancy.
6. An OnlineInfoSession may have 0 people registered for it, but should not go ahead if 0 attend it, it should be cancelled or moved to a later date. This was not possible to represent in the ER model.
7. A HealthStatus attribute was added to the Baby entity set. Its purpose is to account for the health of the baby during and after the pregnancy.

8. An Institution needs to associate each Midwife with a Pregnancy, however, in my ER diagram, an Institution first assigns a Midwife to a Couple, which can introduce faulty situations. For example, a Midwife may be associated to a Pregnancy that is not a part of one of its supervised couples. We need to make sure that does not happen and can't happen.
9. A Baby's name can't be a key, as it can be left NULL for long periods of time.
10. Not all institutions can accommodate births, therefore, it is better to have an attribute in Pregnancy for it.
11. A Couple can have a maximum of two Midwives and MedicalTest can only have a maximum of 2 Midwives as well, which is not possible to capture in the ER diagram.
12. Tests can only be updated by a technician or a Midwife, we don't want anyone else to update it without verification.
13. Appointments can only exist if a Midwife is the one organizing them.
14. All participating constraints in the ER model cannot be taking into consideration when translated to a Relational model. Therefore, MedicalTest, and Pregnancy will both have one relationship each affected by this and that we must keep into account when programming this constraint since it can't be taken into account in the Relational model.
15. The ISA in the ER diagram introduces an overlapping issue in the Relational model. Indeed, a parent can be both a BiologicalDad and BiologicalMom, which must not happen and should be forbidden.
16. The ISA also doesn't ensure 100% coverage of all parents which means that some Parent entities may not be a BiologicalDad or BiologicalMom, which must not happen and must be stopped from happening.
17. In Pregnancy, the FinalEstimatedDate should be decided by the LastMenstruelPDate and UltraSoundDueDate. The Midwife and BiologicalMom are the only ones that can set the FinalEstimatedDate attribute.
18. A Couple can only attend an OnlineInfoSession if they are registered for it.
19. The RecipientOfTest attribute can only be a BiologicalMom or Baby. The BiologicalDad never gets tested for anything. (Assumption #6)
20. A Couple can only be associated to a Midwife only after it has attended at least one OnlineInfoSession (Assumption #13)

Artificial Keys:

1. CoupleID
2. BabyID
3. PregnancyID
4. AppointmentID
5. TestID

Keys Involved in Weak Entities:

1. In the Note entity set: AppointmentID-Date-Time (Date and Time are partial keys from Note, AppointmentID from Appointment)
2. In the OnlineInfoSession entity set: PractitionerID-Date-Time (Date and Time are partial keys from OnlineInfoSession, PractitionerID from Midwife)

Relational Translation:

1. Parent(QcHealthCard, PhoneNumber, Name, BloodType, DateOfBirth, Address, CurrentProfession, Email)
2. BiologicalDad(QcHealthCard, PhoneNumber, Name, BloodType, DateOfBirth, Address, CurrentProfession, Email)
3. BiologicalMom(QcHealthCard, PhoneNumber, Name, BloodType, DateOfBirth, Address, CurrentProfession, Email, TotalNumberOfPreg, CurrentPregNumber)
4. Couple(CoupleID, IsInterestedInProgram, TotalNumberOfPregs, IsInvited, CurrentPregNumber, InforSessionsAttended, ExpectedTimeFrameOfBirth, QcHealthCard)

QcHealthCard foreign key referencing relation BiologicalMom

5. IsDad(CoupleID, QcHealthCard)

CoupleID foreign key referencing relation Couple, QcHealthCard foreign key referencing relation BiologicalDad

The IsDad relation can also be completely revoked by simply adding the key of the relation BiologicalDad to the relation Couple:

Couple(CoupleID, IsInterestedInProgram, TotalNumberOfPregs, IsInvited, CurrentPregNumber, InforSessionsAttended, ExpectedTimeFrameOfBirth, QcHealthCardDad, QcHealthCardMom)

QcHealthCardDad foreign key referencing relation BiologicalDad, QcHealthCardMom foreign key referencing relation BiologicalMom

6. Selects(CoupleID, InstName)

The Selects relation can also be completely revoked by simply adding the key of the relation Institution to the relation Couple:

Couple(CoupleID, IsInterestedInProgram, TotalNumberOfPregs, IsInvited, CurrentPregNumber, InforSessionsAttended, ExpectedTimeFrameOfBirth, QcHealthCardMom, InstName)

InstName foreign key referencing relation Institution, QcHealthCardMom foreign key referencing relation BiologicalMom

We could also have had:

Couple(CoupleID, IsInterestedInProgram, TotalNumberOfPregs, IsInvited, CurrentPregNumber, InforSeassionsAttented, ExpectedTimeFrameOfBirth, QcHealthCardMom, QcHealthCardDad, InstName)

InstName foreign key referencing relation Institution, QcHealthCardMom foreign key referencing relation BiologicalMom, QcHealthCardDad foreign key referencing relation BiologicalDad

7. Institution(InstName, PhoneNumber, Email, Address, Website, TypeOfInstitution, PractitionerID)

PractitionerID foreign key referencing relation Midwife

8. Midwife(PractitionerID, CommunityCenter, BirthingClinic, Name, Email, PhoneNumber, InstName)

InstName foreign key referencing relation Institution

9. Backups(PrimaryMidwife, BackupMidwife)

PrimaryMidwife foreign key references relation Midwife, BackupMidwife foreign key references relation Midwife

10. Pregnancy(PregnancyID, FinalEstimatedDate, LastMenstruelPDate, LocationOfBirth, UltraSoundDueDate, NumberOfBabies, CoupleID)

CoupleID foreign key referencing relation Couple

11. Baby(BabyID, Gender, Name, HealthStatus, BloodType, DateOfBirth, TimeOfBirth, PregnancyID)

PregnancyID foreign key referencing relation Pregnancy

12. Supervises(PractitionerID, PregnancyID)

PractitionerID foreign key referencing relation Midwife, PregnancyID foreign key referencing Pregnancy

13. Attends(CoupleID, PractitionerID, Date, Time, HasAttended, IsRegistered)

CoupleID foreign key referencing relation Couple, (PractitionerID, Date, Time) foreign key referencing OnlineInfoSession

14. OnlineInfoSession(PractitionerID, Date, Time, Language, CouplesAttendance)

PractitionerID foreign key referencing relation Midwife

15. Appointment(AppointmentID, Date, Time, PractitionerID)

PractitionerID foreign key referencing relation Midwife

16. Note(AppointmentID, Date, Time, Observation)

AppointmentID foreign key referencing relation Appointment

17. SamplesAndPerscribes(PractitionerID, TestID)

PractitionerID foreign key referencing relation Midwife, TestID foreign key referencing relation MedicalTest

18. Technician(TechnicianID, Name, PhoneNumber)

19. MedicalTest(TestID, TestResult, TestType, DateLabWorkWasDone, DateTestWasPrescribed, DateSampleWasTaken, RecipientOfTest, TechnicianID, LabName)

TechnicianID foreign key referencing relation Technician, LabName foreign key referencing relation Lab

20. Lab(LabName, NumberOfTests, LabAddress)

With the exceptions of translation 5 and 6, no other relations can be combined.

Furthermore, in the ER model, there are the presence of Key-Participation constraints, Key constraints as well as Participation constraints. Participation constraints, contrary to the other two types of constraints, cannot be represented in a relation model. Therefore, all entity sets, or relationship sets with a Participation constraint were translated to a relation without taken into account the Participation constraint. Moreover, for the Institution to Midwife relation, it was difficult to model the 0 to 1 key constraint, therefore I added foreign keys in both relations for 7 and 8. Additionally, the Midwife to Midwife relationship was difficult to capture, therefore I created an entire new relation at 9 where the composite key is composed of both Midwife keys apart of the relation.