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COMP421 – Project 1

Project

Assumptions

- Assume Technician's pracid and midwife's pracid are of the same database and hence unique, as both are accredited healthcare professionals in the province of Quebec, and this program is run by the Quebec Ministry of health.
- Assume that the parents will still need to interact with other healthcare institutions beyond the Midwife Program: Hence there is not participation constraint on a record being associated to an appointment (eg. in the case of a medical emergency, where the parent goes to the hospital and the midwife wants to input relavent test results or observations). Hence, we assume records must be associated with a patient (and then can be related to a pregnancy), rather than just associating records with appointments and assuming it is possible to determine to ascertain the subject of the appointment (the parents, pregnancy) from there.
- There is a single sample for each test, otherwise a separate Test entity necessary, one LabTechnician processes test.
- A lab is considered a "healthcare institution" we need to provide information for.
- There are some types of samples that the midwife may obtain, however may also be extracted from a lab (the type of test alone is not enough to discern this). Hence we add an attribute to the a Tests' 'Referral' to a lab specifying whether it's a sample being sent for processing, or a sample that must be taken at the lab.
- There is no reason that a dating ultrasound should be treated differently from any other appointment as it has all the same attributes of a test conducted during an appointment: the midwife can still update the pregnancy's associated DueDates with its method being ultrasound (eg as opposed to the mother's initial estimate or last menstrual estimation).
- There is no guaranteed outcome that a child will be produced from a pregnancy, so there is no participation constraint on pregnancy's relation to child.
- Parents must have attended a lease one InfoSession in order to be considered for registration, which is where the both express program interest (an attribute in Pregnancy) and where their attendanceStatus in the InfoSession relationship is updated, so that the database can be used to produce a subset of "eligible pregnancies" to select for the program.
- The 'local facility' that invites the parents for InfoSessions is associated with the midwife program, and thus one of the MidwifeClinics.
- Appointments take place at a MidwifeServicedClinic, though not necessarily the assigned Midwife's home clinic.
- There are multiple technicians that work at a lab, so we must associate each Test with a LabTechnician rather than just the institution of the lab. In theory there is probably a separate lab database that could cross reference this information, but our database is not responsible for this relationship, so we seek to make ours as autonomous as possible.
- The program is large enough to accommodate a large subset of parents who register. Hence the design choice is made to keep all pregnancies, as registered by the program, in the same database regardless of if they are selected for the program. Though if the program is only a small subset of

the parents registered, a separate "selected pregnancies" entity set would be preferrable to avoid unnecessarily long operations.

- We assume that the lab will be the one to assign the LabTechnician. Hence no participation constraint on a test having a LabTechnician, as the Test entity will likely be created by the Midwife hosting an appointment before this assignment.

ER Restrictions

- As this is a midwife database, it doesn't make sense for a parent to exist without a pregnancy entity, nor a pregnancy exist without at least one parent. We would assume that when the first parent registers, the Pregnancy attribute is created and linked to the parent, and the registration confirmation includes the pregid. Then if a second parent registers they may be connected to the existing Pregnancy attribute using the pregid. *Though it is not possible to capture this flow of time in the ER model directly and is the responsibility of the program registration application.* In addition, the attribute of this relation, "type" will describe whether the parent is the parent giving birth or not, depending on their registration input, and will be used to discern who is eligible for medical Tests (only the mother, the 'birthing parent' and the child).
- Pregnancies (and in turn their parents) are associated to InfoSession with the InvitedTo Relation that has attributes for attendance and registration status. We would like to be able to compute the subset of pregnancies that are eligible for the program, assuming they must have registered and attended an InfoSession (and use their expression of interest, an attribute in Pregnancy) to capture a subset of Pregnancies that are 'selected for the program.' *ER does not allow us to visually map subsets with ease, but operations can help us discern this relavent subset from the database.*
- Selection for the program can be checked using an operation to see *if a* Midwife has been assigned to a pregnancy, rather than storing a separate boolean attribute to program selection. *Er does not allow us to model this information accessed through operations.*
- Similar to aforementioned point: The pregnancy is assumed to by the system a home birth at the mother's address *unless* that Pregnancy is participating in the clinicBirthLocation relationship. *ER does not allow us to model these assumptions based on* lack *of relational participation, however storing a boolean variable would be redundant as this information can be ascertained from a simple operation. In ER it is difficult to capture "if this relationship does not exist, then the birthing location is better described as an attribute."*
- The Parent to Pregnancy relation "belongs" attribute specifies whether the parents is the birthing or non-birthing parent. This makes for the most gender neutral/ inclusive categories, however there is nothing in the database limiting the number of parents for a pregnancy to 2.
- Difficult to capture the handling of an instance of an entity set with less specific attribute values in ER, as seen with the single less specific date problem: When a birthing parent (mother) registers, and a pregnancy entity set, and in turn DueDate Entity Set is created, the less specific time frame given by the mother (and input into DueDates with the date of registry) just assigns a due date to the first of the month for consistency in storage.
- Birthing location: Absence of a Pregnancy engaged with a BirthLocation relationship must imply that the pregnancy is having a home birth, where the birthing location will be the address of the mother. However difficult to capture "if this relationship does not exist, then the birthing location is better described as an attribute."

- The 'type' referred to by the attribute of the referral relationship (of Test to Lab) will indicate whether the lab is simply processing a sample or the pertinent individual is expected to come into the lab to have the sample taken. Hence the dateSampleTaken will either be updated as the appointment date when the Midwife takes the sample, or when the sample is taken at the lab.
- Tests's Date of referral is redundant if each record (a Test is a Record) has a date, assume that we can use the date of record as the date of referral, as if a Test occurs from an appointment, the date of the appointment will always be associated. *Difficult to capture this hopping of information in ER.*
- All ISA hierarchies are covering (eg a patient must either be a child or parent). In the case of HealthCareInstitutions, the entity much be wither a Lab, MidwifeServicedClinic or BirthingClinic (in this case the covering subset is not only leaves). Record, HealthcareInstitutions, HealthCarePractitioners and MidwifeServiceEvent ISA hierarchies are disjoint (an InfoSession cannot also be an Appointment). We leave the Patient hierarchy as non-disjoint (a child could later become a parent, if this program exists for a long time, giving us acess to generational information).

List of Artificial Keys

- Instid: institution id
- recordid: record id
- eventid: event id
- pracid: practitioner id
- patid: Patient id
- pregid: Pregnancy id

Relational Translation

Patient(<u>patid</u>, hcardid, name, DOB, bloodType, address)

Parent(<u>patid</u>, phone, email, profession)

Child (<u>patid,</u> gender, pregid)[1]

Foreign Key:

pregid is foreign key referencing Pregnancy, representing bornOf relationship

HealthCarePractitioner (<u>pracid</u>, name, phone)

Lab Technician (<u>pracid</u>)

Midwife (<u>pracid</u>, email, instid)

Foreign Keys:

instid references MidwifeServiceClinic, representing belongs relationship

HealthCare Institution (<u>instid</u>, name, phone, email, address, website)

Lab (<u>instid</u>)

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COMP421 – Project 1

MidwifeServicedClinic(instid)

Birthing Clinic (instid)[2]

Record (recordid, timeInput, eventid)

Foreign Key:

eventid references Appointment, representing pertaining relationship

AppointmentNote(recordid, observation)

Test (recordid, type, sample, result, dateSampleTaken, dateLabWorkCompleted, pracid, instid, type)[3]

Foreign keys:

pracid references Lab Technician, representing processes relationship
intsid references Lab, representing referral relationship, type is attribute of referral relationship

MidwifeServiceEvents(eventid, date, time, instid, pracid)[4]

Foreign Keys:

instid references MidwifeServicedClinic, representing eventLocation relationship

pracid references Midwife, representing host relationship

Appointment (eventid, pregid)[5]

Foreign Key:

pregid references Pregnancy, representing subjectOf relationship

InfoSession (eventid, language)

Pregnancy(pregid, ithPregnancy, numberBabies, programInterest, primaryPracid, secondPracid, instid, dateOfEstimation)

Foreign keys:

primaryPracid references Midwife, representing the primarilyAssigned relationship

secondPracid references Midwife, representing the secondarilyAssigned relationship

instid references HealthCareInstitution, representing the clinicBirthLocation relationship

dateOfEstimation references DueDates, , representing the DueDates weak entity

associated (patid, recordid)

Foreign keys:

patid references Patient

recid references Record

parentsInvited(<u>pregid</u>, <u>eventid,</u> attendanceStatus, registrationStatus)

Foreign Keys:

pregid references Pregnancy

eventid references InfoSession

belongs (<u>pregid</u>, <u>patid</u>, type)[6]

Foreign Keys:

pregid references Pregnancy

patid references Parent

Opportunities to Combine Relations to Avoid Redundancy

- A record is both associated to an appointment (and in turn a pregnancy and its parents), as well as an individual patient. Its redundant to include this relationship between appointment and pregnancy (in turn associating the parents) when we also associate each record with a patient and get the same information. However, to accommodate cases of individual testing (eg a Test just for the mother), makes is possible to directly link individuals to Tests so we retain it.

Relational Translation Restrictions

- All ISA hierarchies are covering. For more information see ER Restrictions.

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[1] If a child is created in the system, for it to be relavent in the database it must be related to a pregnancy. However, we cannot capture this participation constraint.

[2] Translation does not capture that a BirthingClinic is a subclass of a MidwifeServicedClinic.

[3] A Test should always have a referral (participate in the relationship associating it to a lab). However, this participation contraint is not modellable, and the instid linking a test to a lab should not be null. In addition, the type attribute of this referral relationship indidates whether this is lab work being send for processing, or a patient sent for sample collection.

[4] An instance of an event should always have a location and a midwife. However, this participation constraint cannot be modelled.

[5] The subjectOf relation is encoded in appointment, and links Appointments and Pregnancies. An appointment will never have more than one pregnancy as its subject, however it should always have a pregnancy, and in turns its parents, that are associated. This participation constraint is not capturable in this translation, but the pregid foreign key of appointment should not be null.

[6] The 'belongs' relationship between Parents and Pregnancies has participation constraints for both entities that cannot be enforced in this relational model.