Part 1: Smilow Dentistry ERD

Team 2: Anushka Nath, Sam Ziessler, Karl Chavez, Christina Duong

Intr Database Sys (7194)

February 2023

Research Documentation

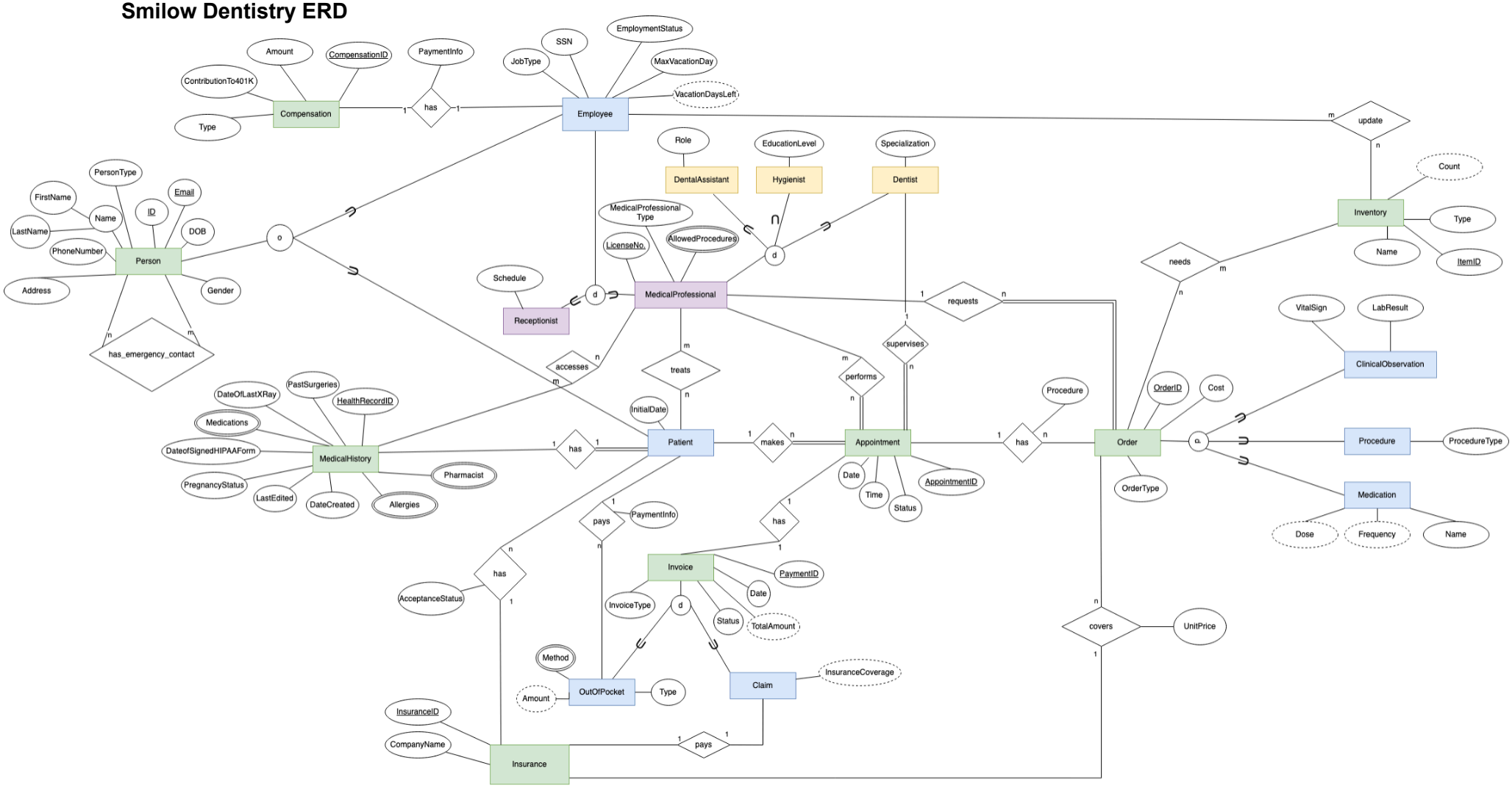
SOURCE 1: National Center for Biotechnology Information (NCBI)
According to NCBI, a medical database must consist of things such as demographic data, administrative data, health risks and health status, patient medical history, current management of health conditions, and outcome data. Demographic data can look like attributes such as age and gender. Additionally emergency contacts should be recorded as well. It may be efficient to group several entities under one large person entity with demographic attributes.
As for administrative data, this may look like the various levels of insurance (dual coverage, copayments, deductibles), payments/charges, and medical tests/examinations. Patient medical history should be taken into account, such as hospital admissions, surgical procedures, pregnancies, information on past medical problems and possibly family history or events. Current management of health conditions may also be present like health screening, current health problems and diagnoses, therapeutic procedures performed, laboratory tests carried out, medications prescribed, and counseling provided.

SOURCE 2: Medical Data Vision
This source detailed more about how to track invoice information. Invoices stored may come from the medical practice itself, as well as outside partners such as pharmacies when ordering medications, medical institutions when ordering laboratory results, and donation information given the practice opts into philanthropic efforts. Moreover, the site discussed various challenges that medical databases must overcome including tracking how many prescription orders are distributed, differentiating between side effects and diseases, etc. These are limitations our group intends to cross-over during our final ERD.

SOURCE 3: HealthIT.gov
This website touched on a very important subject: electronic health records. Essentially, an electronic health record is an online version of a patient's paper chart. EHRs, for short, store critical information that dentists may need real-time access to like "a patient's medical history, diagnoses, medications, treatment plans, immunization dates, allergies, radiology images, and laboratory and test results." On the other hand, electronic medical records (EMRs) are similar to EHRs but instead are specific to one practice. Our group believes that Smilow Dentistry, although one practice unit, should stick to EHRs because of easier transferability.

SOURCE 4: Hunter Business School
This source gave much more high-level information to consider proceeding with our entity relational diagram. For example, we should take into account the insurance claims and following billing procedures that patients possess prior and after their appointments. Additionally, we should carve out sections tracking inventory of medical supplies like gloves, hardware equipment, prescriptions, cleaning supplies, and other administrative tools Smilow Dentistry may need. Our group plans to create a separate entity dedicated to orders, where we'll specify which inventory may need to be updated accordingly. And of course, our database must track financial data going forward to measure the profitable trajectory as a business.

Smilow Dentistry ERD



Added Features

As alluded to in the previous section, we decided to add “Inventory” and “Compensation” entities.

The “Inventory” entity will help the productivity of business operations. Employees can keep track of the inventory of medical supplies and order more when necessary. This will prevent overstock and understock of supplies. This entity will have the attributes “ItemID”, “Name”, “Count” and “Type”. The “ItemID” is the key attribute, “name” is the name of the item, “count” is a weak attribute that is updated regularly to keep count of the supply, and “type” refers to whether it is a medical, cleaning, or office supply. The “Inventory” entity will have relationships connected to “Employees” and “Orders”. These relationships will allow for employees to update the inventory, and for employees to check what supplies are needed for an order related to an appointment.

The “Compensation” entity will help the payroll process for Smilow Dentistry. “Employees” will have a relationship connected to compensation and each employee will have their preferred payment info (direct deposit, check, etc). The “Compensation” entity will have the attributes “CompensationID”, “ContributionTo401K”, “Amount”, and “Type”. The “CompensationID” is the key attribute, and “Type” indicates whether an employee is paid salary or paid hourly. The employees can check and update their contribution to their 401k and payment info. The employees can view their payment history and amount.

Additional Requirements and Assumptions

- Invoices can be paid for in part by insurance claims and in part by the patient out of pocket. The “OutOfPocket” entity has a “type” attribute to indicate whether or not the payment is a copayment, depending on if the patient’s insurance provided a claim.
- The “Medical History” entity has a “DateCreated” attribute, which either indicates when a patient was added to the DB or that a patient is not yet in the system, in the case that it is null.
- Medical History also has a “LastEdited” attribute, which indicates whether or not the patient information is current.
- The “Patient” entity has an “InitialDate” attribute, which indicates when the patient started attending appointments, in contrast to when their medical history was recorded.
- The “Employee” entity has an “EmployeeStatus” attribute, which indicates whether the employee is full-time, part-time, or no longer employed.
- Each employee has a set number of vacation days per year, and has a constantly changing “VacationDaysLeft” attribute to keep track of how many they have used.
- Receptionists, unlike medical professionals, aren’t required to work full time, so they have a “Schedule” attribute to outline any deviations from a 9-5 schedule.
- Although every medical professional in the system will have a unique license number and a list of procedures they are authorized to do, dental assistants can also vary in their role (as either a “Certified Dental Assistant” or an “Expanded Functions Dental Assistant), hygienists can vary in their education level, and dentists can vary in their area of specialization.

- The “Appointment” entity has a “status” attribute, which indicates whether the appointment has been scheduled, completed, or canceled.
- The “Invoice” entity has a “status” attribute, which indicates whether the invoice is pending or has been paid.
- “Type” attribute in compensation stores whether the employee is an hourly or salary employee.
- “JobType” attribute in employee stores whether the employee is part-time or full-time.

Cardinality

- A “Person” can have multiple “EmergencyContact”, and the same emergency contact can be for different people.
- Employees generally have one compensation, but they do not require a salary in the case that they are no longer employed.
- Although all medical professionals should have access to every patient’s medical records, receptionists generally don’t have access to these records.
- Appointments generally have one invoice, but they do not require an invoice in the case that the appointment was canceled.
- Each appointment needs a supervising dentist, and performing medical professionals.
- Multiple medical professionals can treat one patient.
- A patient is not required to have a medical professional to treat them, in the case that they are a new patient.
- Multiple receptionists can update appointments.
- Multiple employees can update multiple inventory items.
- Orders may need multiple inventory items, and an inventory item can be used for multiple orders.
- The patient makes the appointments, and an appointment must be for a patient.

Entities and Attributes

1. Compensation
    a. ContributionTo401K
    b. Amount
    c. Type
    d. CompensationID
2. Person
    a. Address
    b. PhoneNumber
    c. Name
        i. LastName
        ii. FirstName
    d. ID
    e. DOB
    f. Gender
    g. Email
3. MedicalHistory
    a. HealthRecordID
    b. PastSurgeries

    c. DateOfLastXray
    d. Medications
    e. DateOfSignedHIPPAForm
    f. PregnancyStatus
    g. LastEdited
    h. DayCreated
    i. Allergies
    j. Pharmacist
4. Invoices
    a. Status
    b. TotalAmount
    c. Date
    d. PaymentID
    e. InvoiceType
5. Appointment
    a. Date
    b. Time
    c. Status
    d. AppointmentID
6. Insurance
    a. CompanyName
    b. InsuranceID
7. Orders
    a. OrderID
    b. Cost
    c. OrderType
8. Inventory
    a. Type
    b. Count
    c. ItemID
    d. Name
9. Employee
    a. SNN
    b. EmploymentStatus
    c. MaxVacationDay
    d. VacationDaysLeft
10. ClinicalObservation
    a. VitalSign
    b. LabResult
11. Procedure
    a. ProcedureType
12. Medication
    a. Dose
    b. Frequency

    c. Name
13. Patient
    a. InitialDate
14. OutOfPocket
    a. Type
    b. Amount
    c. Method
15. Claim
    a. InsuranceCoverage
16. Receptionist
    a. Schedule
17. MedicalProfessional
    a. AllowedProcedures
    b. LicenseNo.
    c. MedicalProfessionalType
18. DentalAssistant
    a. Role
19. Hygienist
    a. EducationLevel
20. Dentist
    a. Specialization

Useful Inquiries

1. A receptionist must change a patient's appointment status from active to complete upon their exit.
2. A dentist must refer back to a patient's medical history to check for allergies before prescribing medication.
3. A patient pays their medical bill out of their pocket.
4. A hygienist requests for a medication order to stock inventory.

Sample Spreadsheet

https://buckeyemailosu-my.sharepoint.com/:x:/g/personal/nath_55_buckeyemail_osu_edu/EfPyoi500Z1LkEvJuTt_RiMBLdR5dzg0wtnH22JeypZr2A?e=DgMDCm

Member Participation and Contribution

All team members contributed equally to this assignment. Initially, we divided parts for the diagram, and regrouped to discuss questions and concerns. For the documentation, each member was responsible for a section. We worked together as a group for anything not assigned to a member.

Anushka worked on the “Patients” entity and its relation to other entities. She documented the research and summarized it to the rest of the group members. She worked on the sample database.

Sam worked on the “Appointments” entity and “Invoices” entity and their generalizations and relations to other entities. He also worked on documenting the “Additional Requirements and Assumptions”.

Karl worked on the “Orders” entities, its specializations, and its relation to other entities. He documented all the entities and attributes as well.

Christina worked on the “Person” entity, its related generalizations, and relationships. She also documented added features and assumptions. She worked on the sample database.

Sources

https://www.ncbi.nlm.nih.gov/books/NBK236556/#:~:text=A%20record%20that%20is%20comprehensive,health%20conditions%2C%20and%20outcomes%20data.

https://hunterbusinessschool.edu/what-is-a-medical-database-a-medical-office-assistants-guide/

https://www.healthit.gov/faq/what-electronic-health-record-ehr

https://en.mdv.co.jp/column/article/03.html

Good job on organizing and formatting your report. Going forward, ensure that you follow requirements and include all information/data in your report (not the links). Data and research links are present but data does not show evidence of significant research done and data seems to be just guessed/made up and does not follow how it would actually look for this type of business. For example, no data to properly describe procedures. Dental Procedure is the commodity your business sells (your product). This is where all the money comes from. Would be nice to properly describe what you sell. Why do we have an entity Order? Misuse of specializations. How can Procedure s(your product) Medication and Observation be specializations? Compensation entity not related to Medical Records system and would be part of HR software. Redo the ERD. It needs to correctly represent business requirements. Currently it is far from that. Check for correct use of symbols, cardinality, participation must follow the requirements and common logic. Refer to class discussions and examples. Refer to Feedback 1 announcement. Majority of listed items apply to your team. Refer to class examples including Customer-Order-Product examples. At this point, you are at less than 50% of where your ERD needs to be to be used for Part 2 steps. ERD does not pass the majority of cross-check questions.

Consider using Person generalization and Address entities. Make it visually clear which entity set is a generalization and which are specializations. Specializations do not have PKs. Do not overproduce specializations. Remove unnecessary specializations or add attributes to them as discussed in class. We use Specializations only if they have specific attributes or participate in a relationship that are not applicable to other instances in that entity set. Employees should be Medical (have licensure) and Non Medical. Remember to include necessary 'type' or 'flag' attributes. Remember that an Emergency contact is a mandatory data component for a medical information system and your DB must properly store that info. Allergy, Medication, Licensure are most likely going to be entities not attributes. Check for others. Attributes should be attached to the entity they describe. Why do we have AllowedProcedure in Medical professionals? A relationship would show that certain types of licences can perform certain procedures.

Check that you have proper handling of insurance and other forms of payments as required in project description. Different Insurances have different rates for procedures. Consider using specializations for payment methods. They should be disjointed as each payment logically belongs to one category. You should be able to store and apply more than one payment to the same invoice. Get clear understanding about what is an Insurance Company Vs. Insurance Policy and how your DB should store this info. !!! Keep an eye on attributes that describe M:N relationships such as quantities, dates, amounts that depend on both sides. However, Procedure is not an attribute of a relationship between an Appointment and Order.

FYI: Sample procedure data that came up after 2 clicks in Google search:
https://doh.wa.gov/sites/default/files/legacy/Documents/Pubs/410-079-DentalFeeSchedule.pdf?uid=6311634d694ba
https://www.pdffiller.com/jsfiller-desk12/?requestHash=4d3081e03f1b849d61039af18ea4eaf61c3b37eb3cd79967b3ba4bcd9d32baf1&projectId=1208791496&loader=tips&MEDIUM_PDFJS=true&PAGE_REARRANGE_V2_MVP=true&isPageRearrangeV2MVP=true#1e1d9e4c26be4d07b173d7cfcb63fb80