INFO 6210 Data Mgt and Database Design: P2_Database Specification

Group 6

Pei-Ling Chiang, Shuyuan Lyu, Ssu-Yu Ning, Zhehui Yang, Bo-Zhong Zhang, Yuxin Zhang

Database Topic

COVID-19 hospitalization management system

Database Purpose

With the massive amount of COVID-19 patients occupying hospital beds, the purpose of the database is to collect health information of inpatients, improve prognosis, modify treatment strategies, and adjust admission standards in order to manage COVID-19 patients more efficiently. This database will be used by both physicians and hospital administrative staff.

Business Problems Addressed

- Provide patients' information to physicians to give appropriate treatments and further reduce the COVID-19 death rate.
- Allow medical care providers to record and compare different treatment results, which helps to further improve treatment strategies.
- Ensure that physicians can identify the severity of the disease through clinical symptoms and examinations and further adjust admission standards to better control the number of COVID-19 inpatients.
- Allow administrative staff to collect patients' treatment-related information and generate descriptive patient reports.
- Ensure that administrative staff are able to find available beds immediately for COVID-19 patients.
- Supply information to improve the scheduling of admission and discharge, and to allocate scarce medical resources more fairly for COVID-19.
- Permit administrative staff to track geographical distribution of COVID-19 patients to prevent the spread.

Business Rules

- Assume all patients have already been hospitalized.
- Assume each patient has only one current address.
- Assume there can be one or more patients in each address.
- Assume each patient is treated by one or more physicians.
- Assume each physician treats zero or more patients.
- Assume each patient has one or more treatments.

- Assume each treatment is given to zero or more patients.
- Assume each physician can perform zero or more treatments.
- Assume each treatment is performed by zero or more physicians.
- Assume each patient must occupy one bed per admission.
- Assume each bed is occupied by zero or one patient.
- Assume each patient has zero or more medical conditions in his or her medical history.
- Assume each medical condition is shown in zero or more patients' medical history.
- Assume each patient has been admitted once or more.
- Assume each admission record is assigned to only one patient.
- Assume each patient takes zero or more examinations.
- Assume each examination has been taken by zero or more patients.
- Assume each patient has one or more clinical symptoms.
- Assume a clinical symptom is shown in zero or more patients.
- AdmissionType includes emergency admission and regular admission.
- DischargeType includes expire, recovered, and null.

Design Requirements

- Eliminate any multi-valued and/or composite attribute.
- Remove any repeating groups.
- Avoid a many-to-many relationship.
- Pay attention to the multiplicity (cardinality and partition).
- Make sure the type of a relationship is correct (Identifying vs Non-Identifying).
- All entities must be connected.
- Avoid any unnecessary relationship.
- Make sure the ERD and design document match.
- Use Crow's Foot Notation.
- Specify the primary key fields in each table by specifying PK beside the field.
- Specify the foreign key fields in each table by specifying FK beside the field.

Design Decisions

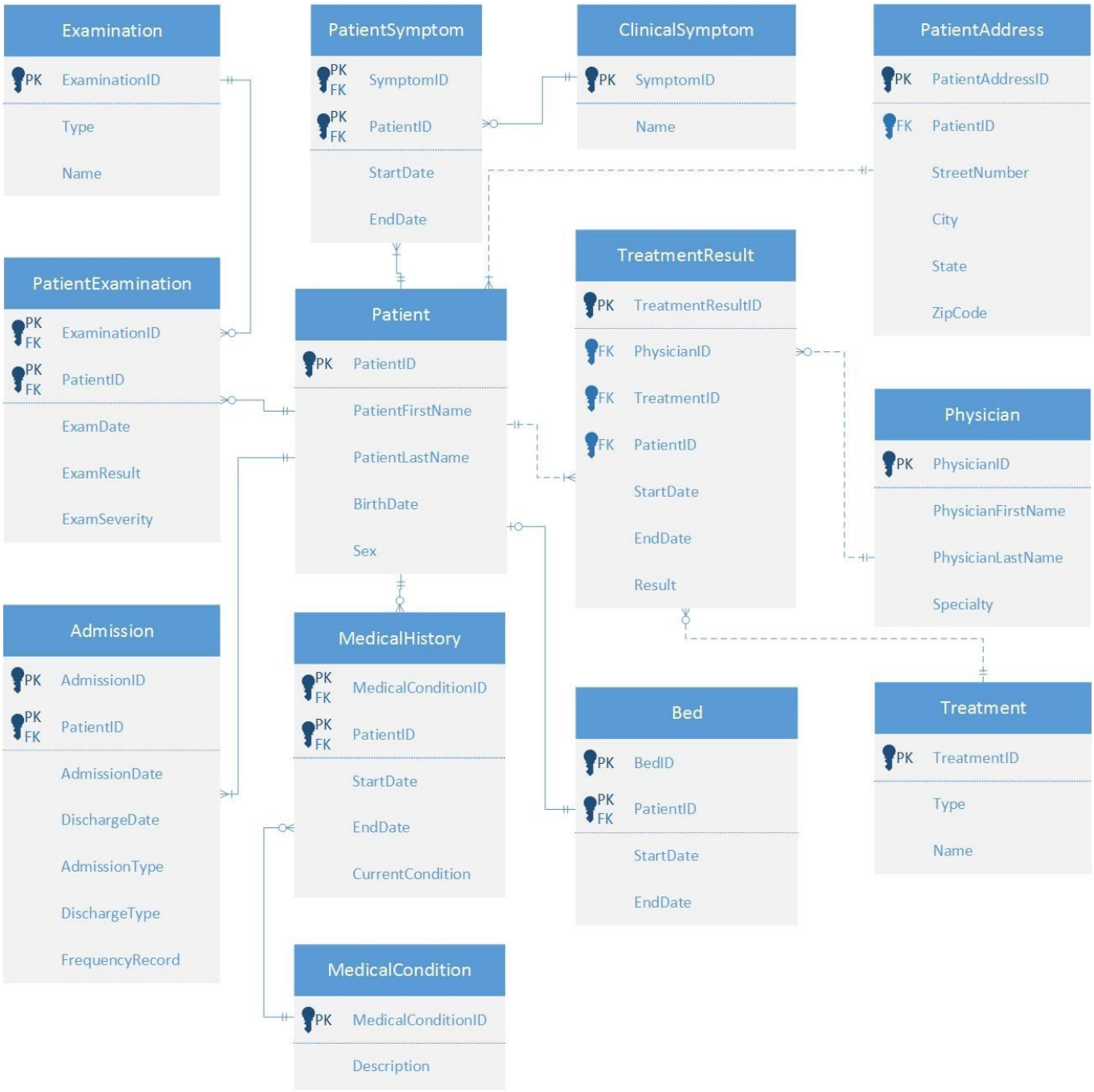
Entity Name	Entity Type	Why Entity Included	How Entity is Related to Other Entities
Patient	Primary	The primary purpose of our database is to manage COVID-19 patients more efficiently. We create “Patient” as the core entity to record patients’ relationships with other entities and further analyze their situation to modify treatment strategies and admission standards. Patients' age and gender can also be used to collect demographic data on Covid-19, making researchers better understand the disease.	As a core entity in this database, the Patient entity has one-to-many identifying relationships with PatientSymptom, PatientExamination, Admission, MedicalHistory. The Patient entity has a one-to-many non-identifying relationship with TreatmentResult. The Patient entity has a many-to-one non-identifying relationship with PatientAddress. The Patient entity also has a one-to-one identifying relationship with Bed.
Patient Address	Primary	One of the objectives of this database is to track the geographical distribution of COVID-19 patients to send alerts and prevent community spread. The PatientAddress entity can be used to predict high-risk locations.	The PatientAddress entity has a one-to-many non-identifying relationship with Patient.
Physician	Primary	Physician is an important entity representing the members of the hospital medical staff. Physicians treat COVID-19 patients by their medical history, and may determine their admission and discharge.	The Physician entity has a one-to-many non-identifying relationship with the TreatmentResult entity. Physicians may order Treatment for a Patient based on other information.

Clinical Symptom	Primary	Clinical symptoms are an important basis for diagnosis. The clinical symptom is a subjective manifestation of a morbid condition reported by a patient. Symptoms differ with severity of the COVID-19 disease, and it will help physicians to assess the health condition of patients, such as, if the patient needs emergency medical care immediately or not. The entity can work as an important reference so that the doctor can diagnose conditions of the disease .	The ClinicalSymptom entity has a one-to-many identifying relationship with PatientSymptom entity.
Admission	Primary	Admission can provide basic time and type records when patients admit to and discharge from the hospital, including AdmissionDate, DischargeDate, AdmissionType, DischargeType, and Frequency Record. By knowing how long each patient stays, the hospital can improve the entire treatment process and adjust admission standards accordingly to maximize the bed utilization.	The Admission entity has a many-to-one identifying relationship with Patient.
Examination	Primary	Examination provides specific information about the patient's examination combined with PatientExamination entity, including Name, Type, ExamDate, ExamResult, ExamSeverity. Physicians can get a better sense of patients' physical condition through examinations. In addition, physicians could determine the severity of the patient by comparing the results of examination with the indicators	Examination entity has a one-to-many identifying relationship with the PatientExamination entity.

		provided by WHO.	
Medical Condition	Primary	MedicalCondition can provide details about patients' medical condition combined with MedicalHistory entity, including Description, StartDate, EndDate, and the CurrentCondition (recovered, continued). As far as we know, patients with certain medical conditions could be at higher risk for severe illness from COVID-19, they need extra precautions. This entity provides important information for physicians to distinguish those high-risk patients, leading to reconsideration and adjustment of existing treatments and admission standards.	MedicalCondition entity has a one-to-many identifying relationship with MedicalHistory entity.
Treatment	Primary	Treatment can provide information about the treatments combined with the TreatmentResult entity, including Type, Name, PhysicianID, PatientID, StartDate, EndDate, and Result. That information can help medical care providers to compare different treatment results, which helps to further improve and modify treatment strategies.	The treatment entity has a one-to-many non-identifying relationship with the TreatmentResult entity.
Bed	Primary	The Bed entity can provide information for administrative staff to look up allocated beds for COVID-19 inpatients. Physicians can immediately find their inpatients according to the BedID recorded in the Bed entity. Both enhance the efficiency of managing the COVID-19 patients.	The Bed entity has a one-to-one identifying relationship with Patient.

Treatment Result	Associative	This TreatmentResult entity is an associative entity that maintains relationships between Physician, Treatment and Patient entities. This entity is created to solve the many-to-many relationships existing between Physician and Treatment entities, Physician and Patient entities, and Patient and Treatment entities.	TreatmentResult entity has many-to-one non-identifying relationships with Treatment entity, Patient entity, and Physician entity separately.
Medical History	Associative	This MedicalHistory entity is an associative entity that maintains relationships between Patient and MedicalCondition entities. This entity is created to solve the many-to-many relationship existing between Patient and MedicalCondition entities.	MedicalHistory entity has many-to-one identifying relationships with Patient and MedicalCondition entities separately.
Patient Examination	Associative	This PatientExamination entity is an associative entity that maintains relationships between Patient and Examination entities. This entity is created to solve the many-to-many relationship existing between Patient and Examination entities.	The PatientExamination entity has many-to-one identifying relationships with Examination and Patient entities separately.
Patient Symptom	Associative	The PatientSymptom entity is an associative entity that maintains the relationship between Patient and ClinicalSymptom. This entity is created to solve the many-to-many relationship existing between Patient and Clinical Symptom entities.	PatientSymptom entity has many-to-one identifying relationships with Patient and ClinicalSymptom entities separately.

Initial ERD


Examination
PK ExaminationID
Type
Name
PatientSymptom
PK FK SymptomID
PK FK PatientID
StartDate
EndDate
ClinicalSymptom
PK SymptomID
Name
PatientAddress
PK PatientAddressID
FK PatientID
StreetNumber
City
State
ZipCode
PatientExamination
PK FK ExaminationID
PK FK PatientID
ExamDate
ExamResult
ExamSeverity
Patient
PK PatientID
PatientFirstName
PatientLastName
BirthDate
Sex
TreatmentResult
PK TreatmentResultID
FK PhysicianID
FK TreatmentID
FK PatientID
StartDate
EndDate
Result
Physician
PK PhysicianID
PhysicianFirstName
PhysicianLastName
Specialty
Admission
PK AdmissionID
PK FK PatientID
AdmissionDate
DischargeDate
AdmissionType
DischargeType
FrequencyRecord
MedicalHistory
PK FK MedicalConditionID
PK FK PatientID
StartDate
EndDate
CurrentCondition
Bed
PK BedID
PK FK PatientID
StartDate
EndDate
Treatment
PK TreatmentID
Type
Name
MedicalCondition
PK MedicalConditionID
Description