Emergency Department Bed Management

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Introduction

Emergency medical records are used to support patient demographic information and other records that are important to the unit. When examining an emergency department, it is important to not only have patient information, but also information about the availability of beds. This project will allow for patient information to be entered and updated as necessary, as well as updates to available beds within a particular emergency department location. The database created will support all basic functionality to store the information for easy access to the stakeholders. Having these records in a database will help to reduce human error regarding keeping patient records and ease the burden of having to manually keep track of those records.

The design of the database is based around the individual patient information. The patient\_id attribute is used throughout all tables in which the patient is associated with. Each ID is unique as patients may share the same name or the same provider. A patient may have multiple symptoms and may have multiple visits as well. The times listed in the visit table can apply to multiple patients in different locations.

Functional Requirements  
 There are eight different tables within the database. The bed table displays all information relating to available beds in a specified location. If the bed is available, then the patient\_id column will be a null value. The billing table displays all costs associated with a patient’s specific visit. The clinical\_care table displays results from testing as well as the diagnosis and the symptoms that the patient presented. The patient table displays demographic information about the patient such as their name and age. The provider table shows the name and specialty of the provider, and the patients that are associated with them. The patient\_provider table includes all associations between a patient and a provider that they have visited. The supplies table involves cost of supplies that the provider will need to purchase. The visit table contains the information about each individual visit that a single patient has made.

ER Diagram

The ER diagram shows the relations between each of the eight tables (classes). Patients can be associated with providers, clinical care, and beds. Each visit will incur a visit cost. Providers are responsible for the purchase of supplies and can be associated with one or many patients.

A picture containing table

Description automatically generated

UML Diagram

Zero-to-one patients can occupy a single bed. A patient has an association with the clinical care class. A patient has a single provider, and providers many have an indefinite number of patients. A single provider may need to purchase zero to many supplies. Patients and providers are both associated with a particular visit. Each visit results in a bill to the patient, and patients may receive zero to many bills.

Diagram

Description automatically generated

Proof of BCNF

Since patient and provider names are given unique column names specific to that table, and last names and first names are separated, this avoids any non-atomic values within the tables. The tables satisfy first normal form due to only containing atomic values, and each record in the tables being a unique record, typically identified by an ID.

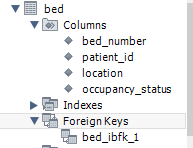
To satisfy second normal form, there must be no partial dependencies within the billing and visit tables. Since there are no tables with multiple primary keys, there will not be any partial dependencies in the tables.

Eliminating transitive dependencies is required to satisfy third normal form. This means that all non-prime keys must not depend on another non-prime key. All the patient, provider, and supply information are dependent on only the primary key of ID, as it is the only variable which must be unique. For instance, there could be multiple people named John Smith, or multiple purchases of the same supplies.

Boyce-Codd Normal Form ensures that no primary keys can be dependent on a non-primary key. Within the patient table, none of the variables can uniquely identify the primary key of ID. It is not possible to get the ID using any of the non-primary keys, as none of the variables must be unique. There could be multiple people with the same gender, date of birth, name, and insurance. For the address, there could be multiple people living at the same address as well. Therefore, this table and the others satisfy Boyce-Codd Normal Form.

Table Information

Bed table with 4 columns, 1 foreign key



Billing table with 4 columns, 2 foreign keys

Graphical user interface, text, application

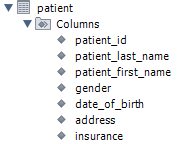
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Clinical care table with 6 columns, 1 foreign key

Graphical user interface, text, application

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Patient table with 7 columns



Patient\_provider table with 2 columns, 2 foreign keys

Graphical user interface, text, application

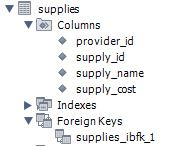
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Provider table with 4 columns

Text

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Supplies table with 4 columns, 1 foreign key



Visit table with 4 columns, 1 foreign key

Graphical user interface, text, application

Description automatically generated

Tools Used

MySQL Workbench 8.0 CE (Database and ER Diagram)

Draw.io (UML Diagram)