

Database Design Document (DBDD)

The A Team Veteran Hospital Database

Version 1.0

Revision 1

November 25, 2019

The A Team

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Contents

Revision History	1
Purpose	2
Narrative	3
Requirements (actors and roles)	5
Entities Identified to be Tracked	6
Entities with Attributes Nested	7
Business Rules	9
Entity Relationship Documentation (ERD, EERD)	10
Relational Schema	12
List of Tables by Name and Attribute	13
Data Dictionary	14
Database Diagram	18
Tables by Schema	19
Table Views	20
User Acceptance Test Queries	26
User Reports	27

Version	Description
1.0	First released draft
1.0 Rev. 1	<p>Summary of changes:</p> <ol style="list-style-type: none"> 1. Added page numbers 2. Revised TOC to add page numbers 3. Added Database Diagram 4. Edited Tables by Schema section 5. Edited Table Views section

Purpose

This document describes the design process that was used to create a database for The A Team Veteran Hospital. It describes the entities and attributes that are tracked in the database and metadata. This document provides useful user test queries and user reports that have been generated from the database design described.

Narrative

The hospital employs numerous nurses. Each nurse is assigned a unique sequential employee number when they are hired. In addition to this number, the hospital records the nurse's name (first and last) and home phone number. The supervisory relationship between nurses is also recorded, as some nurses supervise one or more other nurses. No nurse is supervised by more than one nurse, and some nurses are unsupervised.

The hospital is made up of several different wards (treatment areas). Each ward has a unique name. In addition to the name of the ward, the hospital records the ward's location and phone number.

Each day, the nurses on duty are assigned to wards. Each ward always has at least one nurse assigned to it. A given nurse is always assigned to at least one ward and may be assigned to more than one. The hospital records the specific dates that each nurse is assigned to each ward, as well as the number of hours worked in the ward by each nurse on that date.

Each ward has exactly one charge nurse. This nurse is in charge of maintaining the medical records of the ward. Not all nurses act in this capacity, but those that do are in charge of only one ward.

Wards are made up of beds. Each bed is identified by a unique sequential bed number and is assigned to only one ward. The hospital stores information on its beds including their size (small, large, extra-large) and type (whether or not the head and the foot of the bed can be elevated electrically or manually). Most beds are large size and manually operated.

Information on patients is stored with a required patient number (a unique sequential number assigned to each patient upon each admission), the patient's name (first and last), gender, and date of birth. The date the patient is admitted to the hospital and the date the patient is discharged are also recorded.

The specific bed to which each patient is assigned at any given time is also tracked. Not all beds are necessarily in use at any given time, and a bed may not be assigned to more than one patient.

Each patient is admitted to the hospital by one physician. Some of the staff physicians admit many patients while others admit none. Information stored about each physician includes his or her DEA Number (a unique identifier assigned to each physician by the state), name (first and last), phone number, and the one or more medical specialties in which he or she is certified (e.g., cardiology, obstetrics, etc.).

The hospital records information on the specific treatments that it provides to patients. Each of the treatments available to administer to the hospital's patients is identified by a unique sequential treatment number. Additional information stored for each treatment includes its name, description, and charge.

In addition to admitting patients, many physicians are involved in the treatment of patients. The hospital tracks which treatments are administered to which patients by which physicians. It also tracks the date and time of each treatment administration and the results. Some physicians (e.g., lab researchers) are not directly involved in patient treatments while others are frequently involved in treating patients.

A given patient may receive no treatments or may receive many, and some patients may receive their treatments from more than one physician. Some treatments have yet to be used while others have been used often.

In addition to treatments, patients also incur numerous other charges during their stay in the hospital. The hospital tracks these charges as "items" and stores information on what items have been charged to which patients, based on date and quantity. Information that is to be stored for each item includes a unique sequential item number, the item name and charge. All patients incur some charges for items upon admission and others during their stay. Some items are widely used by patients while others may be new or unusual in nature and will not necessarily be charged to any of the patients in the hospital.

Requirements (Actors and Roles)

Nurse – A nurse may supervise other nurses. A nurse is assigned to a ward. May be designated as Charge nurse for a ward.

Ward - Each ward has a different location in the hospital and is made up of various beds.

Bed – A bed is assigned to a patient. A bed is a specific size and type.

Patient – A patient is admitted by a physician. May be prescribed a treatment plan. Each patient incurs charges from admission to discharge.

Item – Patient charges are tracked as items. They are tracked by patient, date and quantity.

Physician – A physician admits a patient and administers a treatment plan. Treatment – A treatment plan is prescribed to a patient by a physician.

Entities Identified to be Tracked

Nurse

Ward

Bed

Patient

Item

Physici

an

Treatment

Entities with Attributes Nested

NURSE

Nurse ID

First

name

Last

name

Home phone

number WARD

Ward name

Location

Phone

number

Charge nurse

BED

Bed ID

Size

Type

PATIEN

I

Patient ID

First name

Last name

Gender

Date of

birth

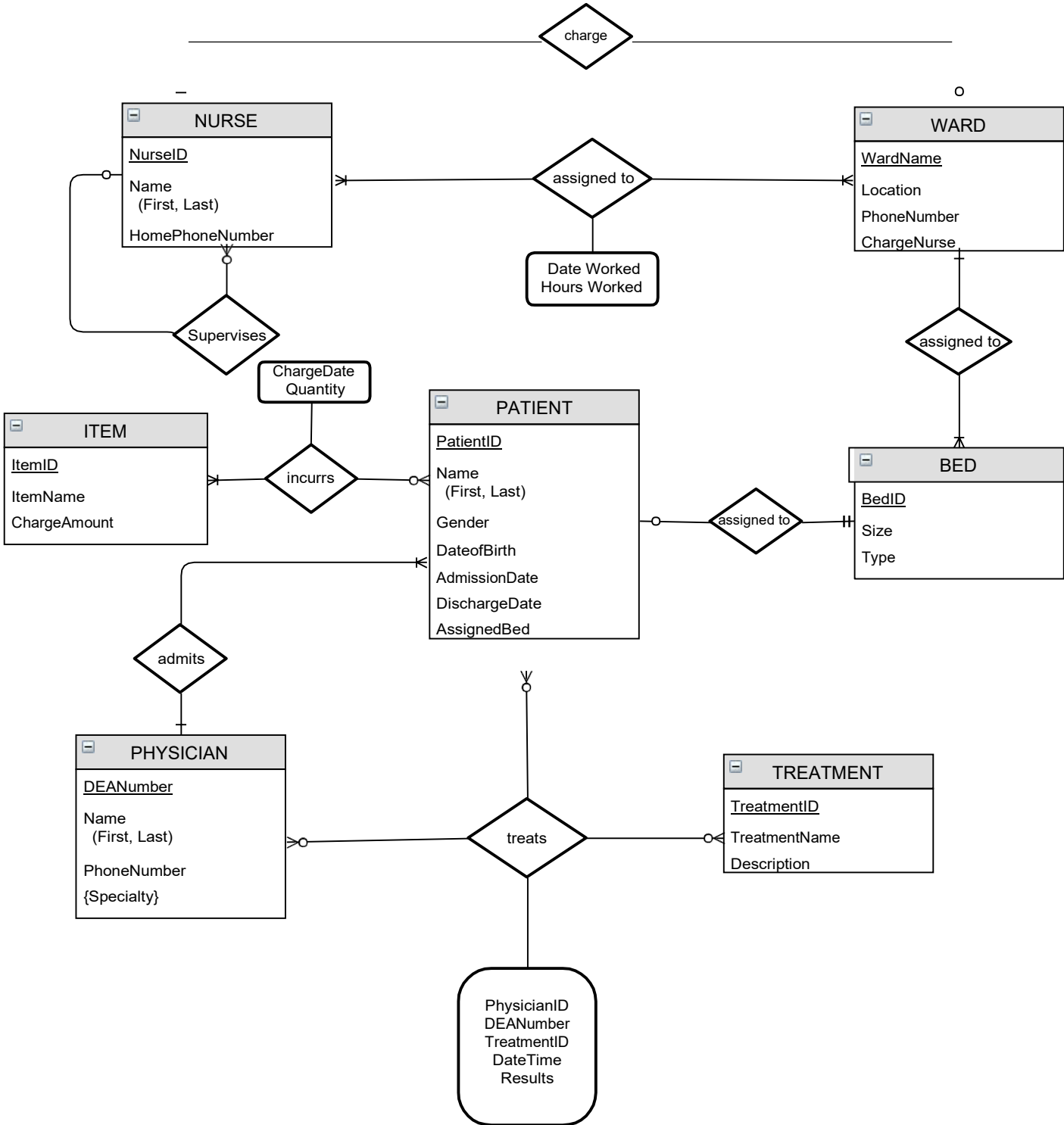
Admission date

Discharge
date Assigned
bed ITEM
Item ID
Item
name
Charge
amount
PHYSICIAN
DEA number
First name
Last name
Phone
number
Specialty
TREATMENT
Treatment ID
Treatment
name
Description

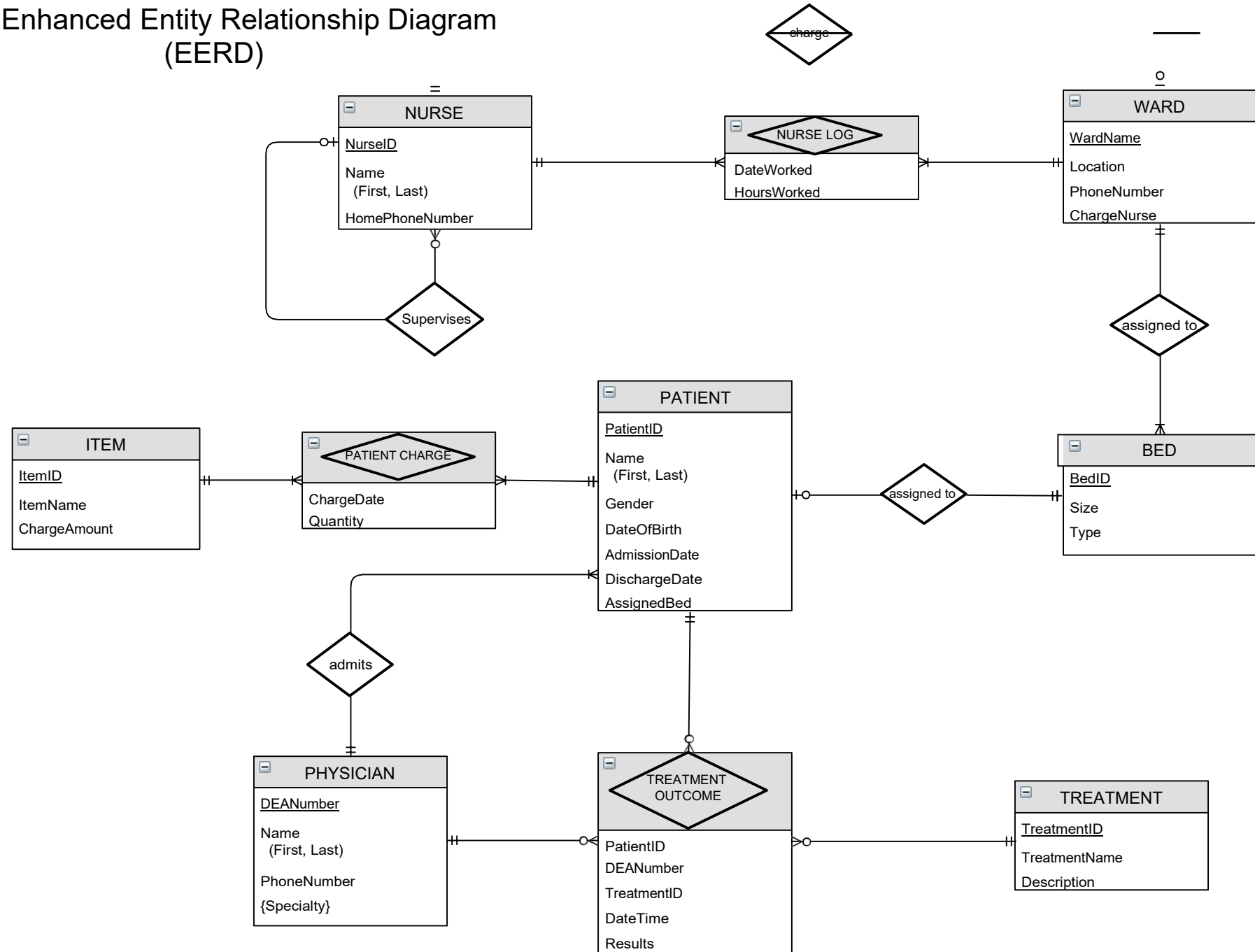
Business Rules

1. A nurse can supervise one or more nurses; but a nurse can only be supervised by one and only one nurse.
2. A nurse is assigned to one and only one ward; a ward can have one or more nurses assigned to it; one nurse per ward is assigned as the charge nurse.
3. A bed is assigned to one and only one ward; a ward has many beds.
4. A patient is assigned to one and only one bed; a bed can be assigned to zero or one and only one patient.
5. A patient is charged one or more items; and an item can be charged to one or more patients.
6. A physician admits zero, one or more patients; a patient is admitted by one and only one physician.
7. A patient receives zero, one, or more treatments; a treatment is assigned to zero, one or more patients.
8. A physician administers zero, one or more treatments; a treatment is assigned to zero, one or more physicians.

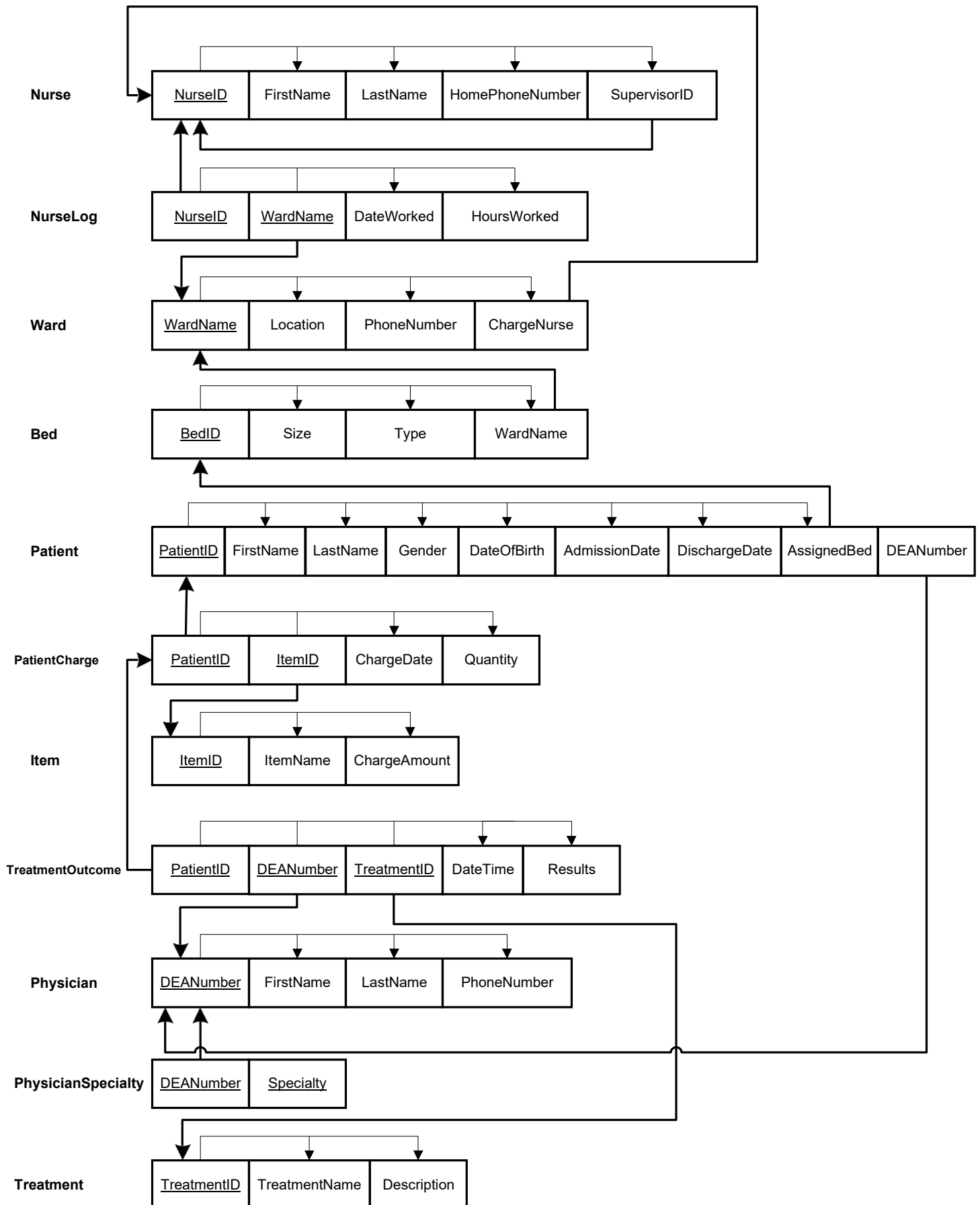
Entity Relationship
Diagram
(ERD)



Enhanced Entity Relationship Diagram (EERD)



Relational Schema (RS)



Data Dictionary Summary Header

HOSPITAL DATABASE TABLES AND ATTRIBUTES

Bed (BedID, Size, Type,

WardName) Item (ItemID,

ItemName, ChargeAmount)

Nurse (NurseID, FirstName, LastName, HomePhoneNumber,

SupervisorID) NurseLog (NurseID, WardName, DateWorked,

HoursWorked)

Patient (PatientID, FirstName, LastName, Gender, DateOfBirth, AdmissionDate, DischargeDate, BedID,

DEANumber) PatientCharge (PatientID, ItemID, ChargeDate, Quantity)

Physician (DEANumber, FirstName, LastName, PhoneNumber)

PhysicianSpecialty (DEANumber, Specialty)

Treatment (TreatmentID, TreatmentName, Description)

TreatmentOutcome (PatientID, DEANumber, TreatmentID,

DateTime, Results) Ward (WardName, Location, PhoneNumber,

ChargeNurse)

HOSPITAL – DATA DICTIONARY

(Microsoft SQL Server Notation)

Table: **Bed**

Column Name	Description	Data Type	Size	Identity	Unique	Default	Check	Allow Nulls	Index
BedID	PK ; Unique sequential bed ID number	smallint		Y					Y
Size	Bed size	varchar	11				([Size] = ('Small') OR [Size]='(Large') OR [Size]='(Extra-Large'))		
Type	Bed mode of operation	varchar	10				(([Type] = ('Electronic') OR [Type]='(Manual'))		
WardName	FK to Ward table; location of bed	varchar	30						

Table: **Item**

Column Name	Description	Data Type	Size	Identity	Unique	Default	Check	Allow Nulls	Index
ItemID	PK ; Unique sequential item ID number	int		Y					Y
ItemName	Name of item	varchar	30						
ChargeAmount	Item charge amount	money					>0		

Table: **Nurse**

Column Name	Description	Data Type	Size	Identity	Unique	Default	Check	Allow Nulls	Index
NurseID	PK ; Unique sequential nurse ID number	smallint		Y					Y
FirstName	Nurse first name	varchar	15						
LastName	Nurse last name	varchar	20						
HomePhoneNumber	Nurse home phone number	char	14				LIKE '([0-9][0-9] [0-9]) [0-9][0-9] [0-9]-[0-9][0-9] [0-9][0-9]'		

SupervisorID	Recursive FK ; synonym for NurseID; nurse's supervisor	smallint						Y	Y
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Table: **NurseLog**

Column Name	Description	Data Type	Size	Identity	Unique	Default	Check	Allow Nulls	Index
NurseID	CPK; FK to Nurse table	smallint							Y
WardName	CPK; FK to Ward table	varchar	30						Y
DateWorked	Date nurse worked	date					>=GETDATE()		
HoursWorked	Hours nurse worked	tinyint							

Table: **Patient**

Column Name	Description	Data Type	Size	Identity	Unique	Default	Check	Allow Nulls	Index
PatientID	PK ; Unique sequential patient ID number	smallint		Y					Y
FirstName	Patient first name	varchar	15						
LastName	Patient last name	varchar	20						
Gender	Patient gender	varchar	6				'Female' OR 'Male'		
DateOfBirth	Patient date of birth	date					YYYY-MM-DD		
AdmissionDate	Patient admission date	date					YYYY-MM-DD		
DischargeDate	Patient discharge date	date					YYYY-MM-DD	Y	
AssignedBed	FK to Bed table; synonym for BedID; bed assigned to patient	smallint							
DEANumber	FK to Physician table; physician that admitted a patient	smallint							

Table: **PatientCharge**

Column Name	Description	Data Type	Size	Identity	Unique	Default	Check	Allow Nulls	Index
PatientID	CPK; FK to Patient table	smallint							Y
ItemID	CPK; FK to Item table	int							Y
ChargeDate	Date patient incurred charge	date					YYYY-MM-DD		
Quantity	Quantity of charges	smallint					>0		

Table: **Physician**

Column Name	Description	Data Type	Size	Identity	Unique	Default	Check	Allow Nulls	Index
DEANumber	PK ; Unique physician ID number	smallint							Y
FirstName	Physician first name	varchar	15						
LastName	Physician last name	varchar	20						
PhoneNumber	Physician phone number	char	14				LIKE '([0-9][0-9] [0-9]) [0-9][0-9] [0-9]-[0-9][0-9] [0-9][0-9]'		

Table: **PhysicianSpecialty**

Column Name	Description	Data Type	Size	Identity	Unique	Default	Check	Allow Nulls	Index
DEANumber	CPK ; FK to Physician table	smallint							Y
Specialty	CPK ; Physician specialty	varchar	45						Y

Table: **Treatment**

Column Name	Description	Data Type	Size	Identity	Unique	Default	Check	Allow Nulls	Index
TreatmentID	PK ; Unique treatment ID number	smallint							Y
TreatmentName	Name of treatment	varchar	30						
Description	Treatment description	varchar	150						Y

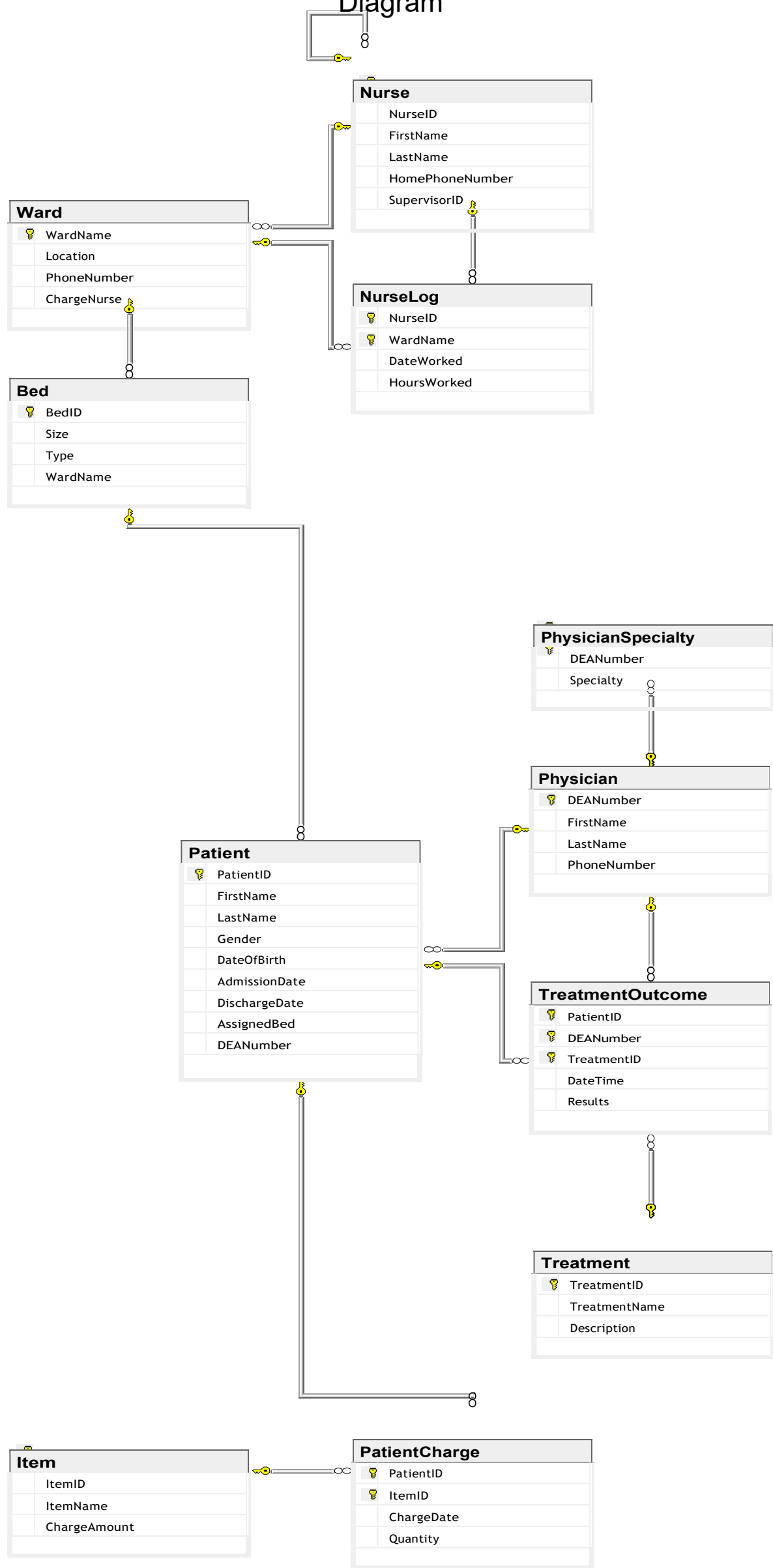
Table: **TreatmentOutcome**

Column Name	Description	Data Type	Size	Identity	Unique	Default	Check	Allow Nulls	Index
PatientID	CPK ; FK to Patient table	smallint							Y
DEANumber	CPK ; FK to Physician table	smallint							Y
TreatmentID	CPK ; FK to Treatment table	smallint							Y
DateTime	Date and time of treatment outcome	smalldatetime							
Results	Treatment results	varchar	150						

Table: **Ward**

Column Name	Description	Data Type	Size	Identity	Unique	Default	Check	Allow Nulls	Index
WardName	PK ; Unique ward name	varchar	30						Y
Location	Ward location	varchar	20						
PhoneNumber	Ward phone number	char	14				LIKE '([0-9][0-9][0-9]) [0-9][0-9][0-9]-[0-9][0-9][0-9][0-9][0-9]'		Y
ChargeNurse	FK to Nurse table; synonym for NurselD; nurse in charge of ward	smallint							Y

Database Diagram



Tables by Schema

View of all tables created in the database:

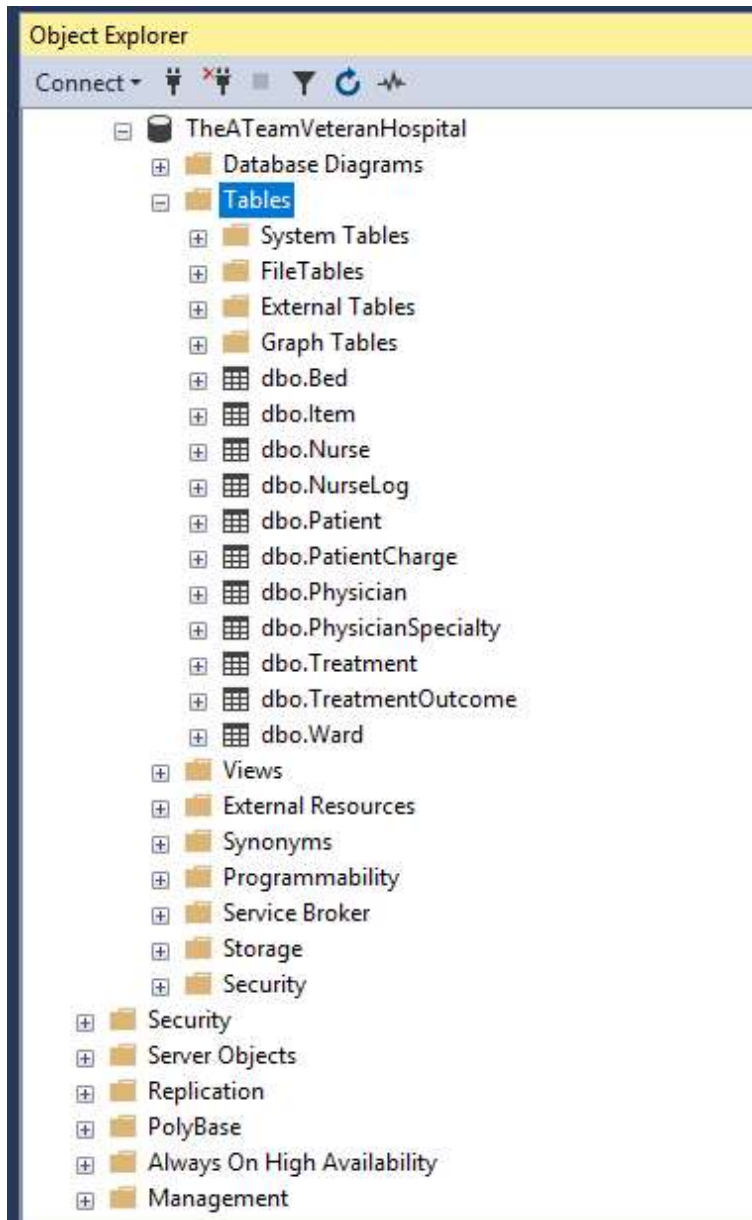
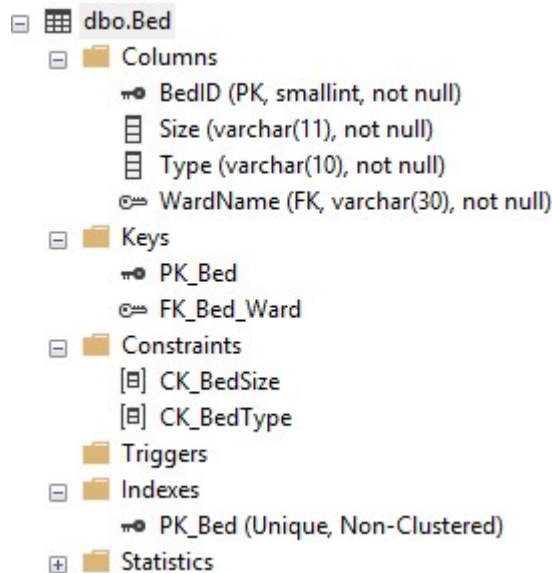
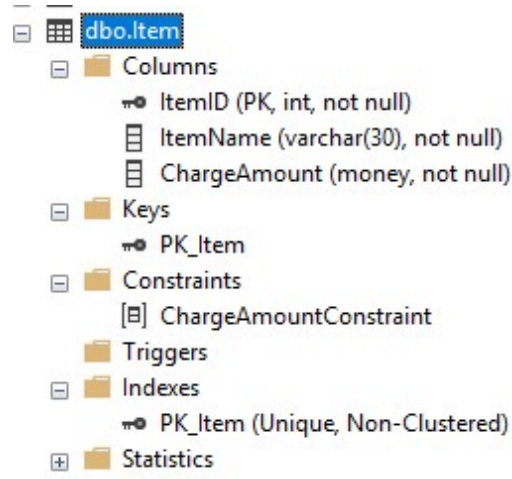


Table Views

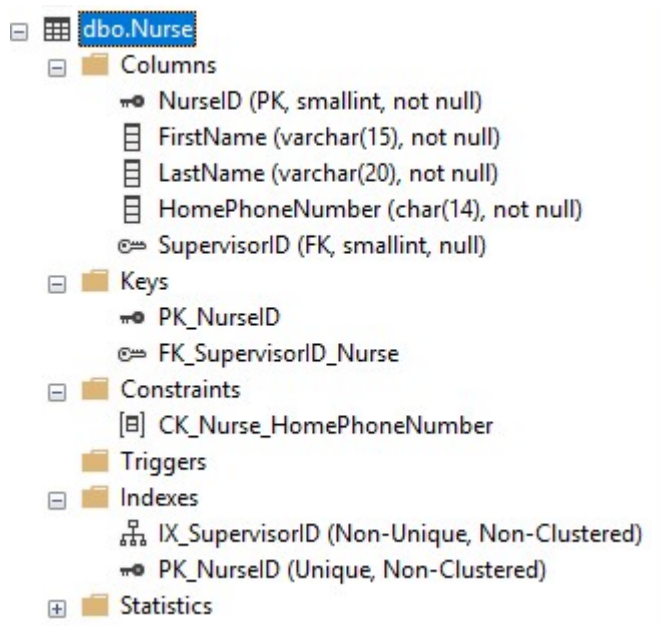
Bed Table: A bed is assigned to one and only one ward, this is tracked by the WardName foreign key in this table. Beds are tracked by the BedID generated in the database. Bed size and type are tracked with check constraints to only allow Manual or Automatic for bed type and either small, large or extra-large for bed size.



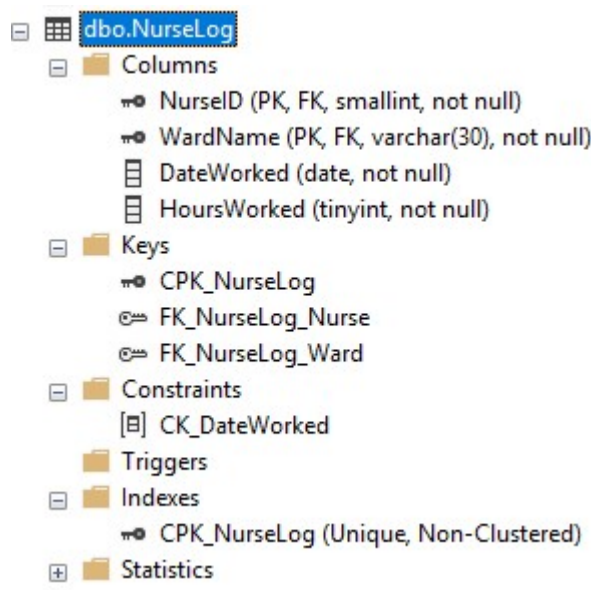
Item Table: Patient charges are tracked as items. An item is tracked by the ItemID generated in the database. The ItemName and ChargeAmount columns show the name of the charge and the dollar amount. There is a check constraint on ChargeAmount to ensure dollar amounts are greater than \$0.



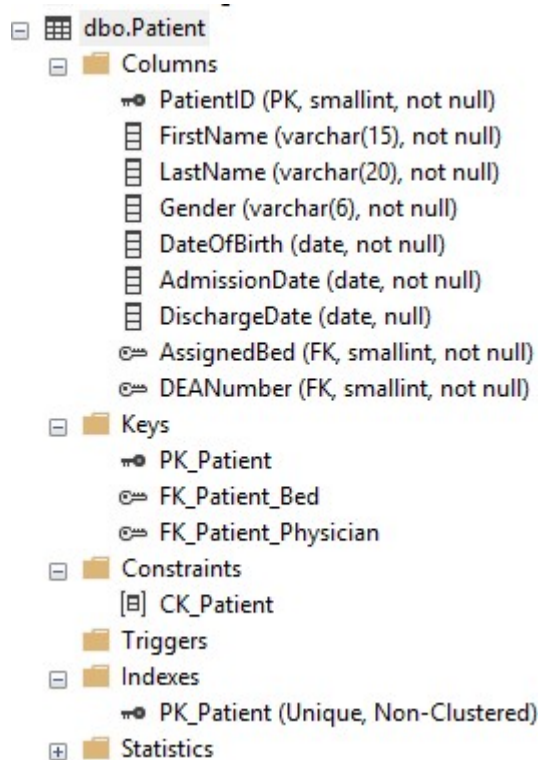
Nurse Table: Nurses are tracked by the NurseID generated in the database, their full name and personal phone numbers are tracked. Some nurses supervise other nurses, this is tracked by a recursive foreign key to NurseID. There is a check constraint on HomePhoneNumber to ensure proper phone number format.



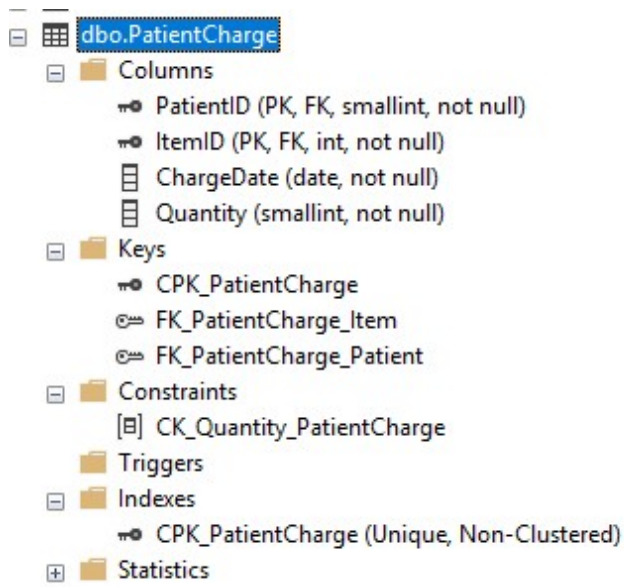
NurseLog Table: The NurseLog tracks nurse assignment's to wards and dates and hours worked in that ward. Each entry is tracked by a composite primary key made up of NurseID and WardName that serve as foreign keys to the Nurse and Ward tables respectively. The check constraint in DateWorked ensures the dates being entered are not for future dates.



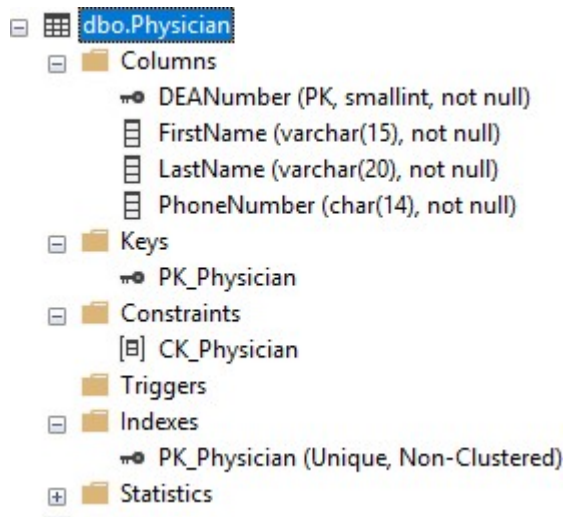
Patient Table: Patients are admitted by physicians and this is tracked by the foreign key DEANumber that links to the physician table. Patients are tracked by the PatientID generated in the database. A patient's full name, gender, date of birth, admission and discharge dates are recorded. A single patient can be assigned to a single bed and this is tracked by the AssignedBed column that works as a foreign key to BedID in the Bed table.



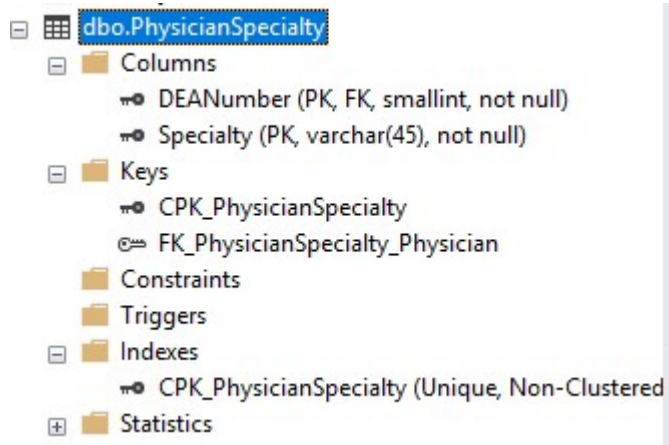
PatientCharge Table: Patient charges are tracked by a composite primary key composed of PatientID and ItemID that serve as foreign keys linking back to the Patient and Item tables respectively. The date the charges were incurred are tracked in the ChargeDate column and the quantity of each item charge is tracked in the Quantity column. There is a check constraint to ensure a quantity entered is greater than zero.



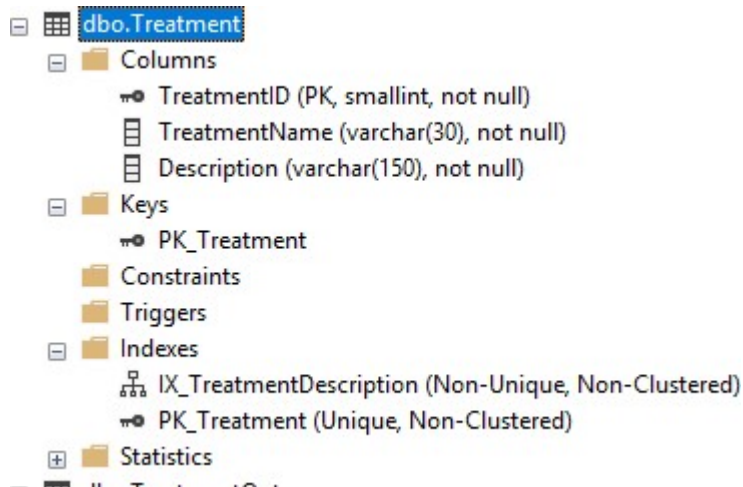
Physician Table: A physician is tracked by their own DEA Number, their full name and personal phone number are recorded. A check constraint is used to ensure a proper format for the PhoneNumber column.



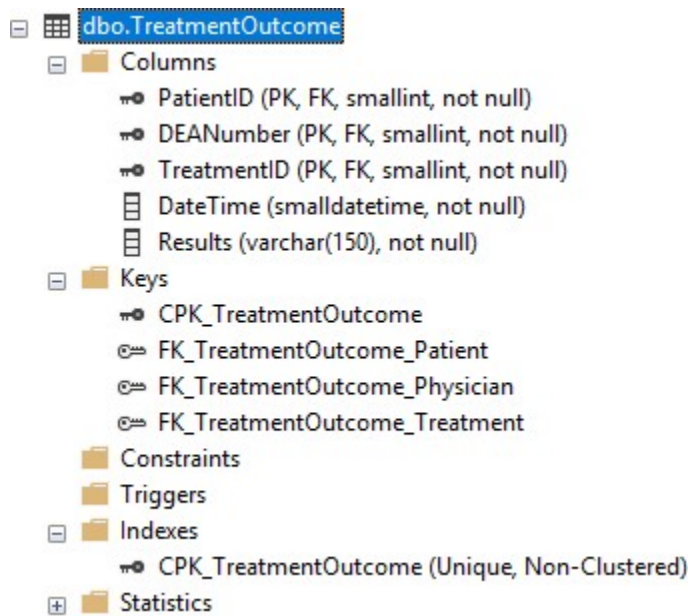
PhysicianSpecialty Table: A physician can have one or many specialties and these are tracked in their own table by a composite primary key made up of the physician's DEANumber which serves as a foreign key to the physician table and of a Specialty column.



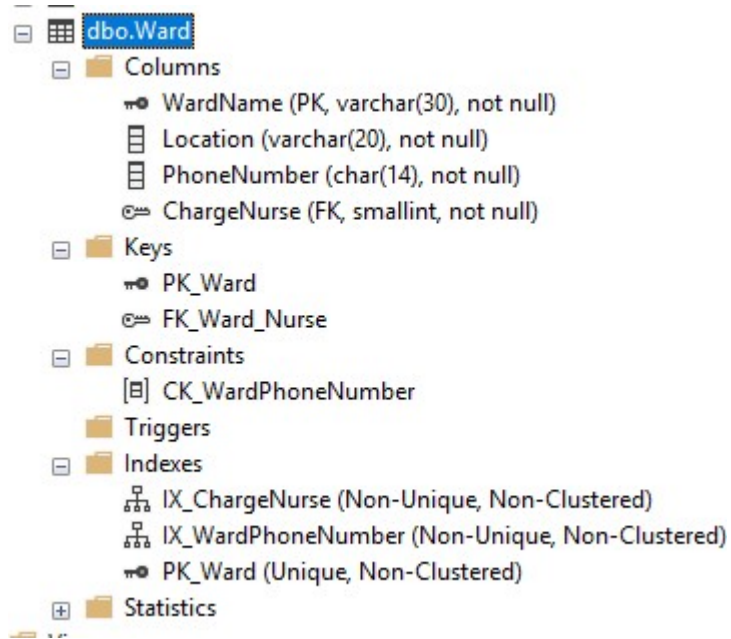
Treatment Table: Each treatment offered at the hospital is tracked in the database by a unique TreatmentID generated in the database. Treatment name and description are recorded.



TreatmentOutcome Table: Each treatment prescribed is tracked individually in the database by a composite primary key composed of PatientID, DEANumber and TreatmentID that serve as foreign keys linking back to the patient, physician and treatment tables respectively. The date and time each treatment was administered, and the final results of the treatment are recorded.



Ward Table: The hospital is made up of various wards, each ward is tracked individually by their unique name in the WardName column. A ward's location, phone number and charge nurse are also tracked. ChargeNurse works as a foreign key linking back to NurseID in the Nurse table. A check constraint is used to ensure the proper format for the ward's phone number.



User Acceptance Test Queries

How many hours did each nurse work for the month of November per Ward?

```
Select NurseID, HoursWorked, DateWorked, WardName
From NurseLog
Where DateWorked BETWEEN '2019-10-31' and '2019-12-01'
Group By WardName, NurseID, HoursWorked, DateWorked
Order By SUM (HoursWorked) DESC
```

What items does the hospital provide that are under \$1000?

```
Select ItemID, ItemName, ChargeAmount
From Item
Where ChargeAmount < '1000'
Group by ItemName, ItemID, ChargeAmount
Order by ChargeAmount ASC
```

Nurse Hours Worked by Ward for November 2019

Ward Name	Nurse ID	Hours Worked	Date Worked
Andrew Diaz	107	8	11/16/2019 12:00:00 AM
	108	8	11/18/2019 12:00:00 AM
Total		16	
Elena Perez	110	12	11/16/2019 12:00:00 AM
	106	12	11/17/2019 12:00:00 AM
Total		24	
Raquel Hickson	109	12	11/18/2019 12:00:00 AM
	110	10	11/19/2019 12:00:00 AM
	108	9	11/16/2019 12:00:00 AM
Total		31	
Ryan Orsini-Brophy	107	10	11/17/2019 12:00:00 AM
	109	8	11/16/2019 12:00:00 AM
Total		18	
Stella Ford	107	10	11/18/2019 12:00:00 AM
	111	10	11/16/2019 12:00:00 AM
	105	8	11/18/2019 12:00:00 AM
Total		28	
Tamara Wodu	106	9	11/16/2019 12:00:00 AM
	111	8	11/19/2019 12:00:00 AM
Total		17	
Will Smith	106	12	11/20/2019 12:00:00 AM
	111	10	11/20/2019 12:00:00 AM
	105	10	11/16/2019 12:00:00 AM
Total		32	

Charge Items (Under \$1,000 Price Range)

Charge Amount	Item ID	Item Name
35.0000	1010	Tylenol
110.0000	1000	IV Bag
350.0000	1030	Room - Overnight Stay
379.5000	1050	Pharmacy General
396.0000	1090	EKG/ECG General
475.0000	1020	EMT Services
585.0000	1100	Lab Hematology