**Data Model**

Let us see the data model of the Bahmni, followed by the proposed model.

**BAHMNI DATA MODEL**

Bahmni Data Model is based on OpenMRS 1.11 A Concept is a data point pertaining to a Patient.

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| **concept** |
|  **Field Name** |  **Data Type** |  **Description** |
| concept\_id | integer(10) | Unique internal number identifying a pre-defined Concept in the Concept Dictionary |
| retired | bit | Signifies if a Concept may be actively referred to in the system or not. It may be mapped to OBS data from the past. |
| short\_name | varchar(255) | A short non-unique name for a concept, typically used in flowsheets or reports where there is very little room.  |
| description | long varchar(65535) | A paragraph description or definition for a concept. Used to disambiguate or otherwise explain the concept that can only be recorded as a concept name. |
| form\_text | long varchar(65535) | User Interface description for components |
| datatype\_id | concept\_datatype.concept\_datatype\_id | Datatype ID associated with a Concept datatype (coded, text, etc.) |
| class\_id | concept\_class.concept\_class\_id | Class or Type of Concept (Diagnosis, Drug Ingredient etc.) |
| is\_set | bit | Identifies if the Concept is meant to group together other concepts (into a set) |
| creator | users.user\_id | Specifies the Person ID of the Person who created or entered the Concept name and details in the system - Administrator |
| date\_created | timestamp(19) | Specifies the Date on which this Concept was entered/stored in the system to be used by the Administrator |
| version | varchar(50) | Specifies the version of the defined Concept |
| changed\_by | users.user\_id | Specifies the Person ID of the Person who last edited the definition of the Concept - Administrator |
| date\_changed | timestamp(19) | Specifies the Date on which the definition of the Concept was last edited |
| retired\_by | users.user\_id | Specifies the Person ID of the Person who removed this Concept from the list of active Concepts that could be referred to - Administrator |
| date\_retired | timestamp(19) | Specifies the Date on which this drug was removed from the list of active referable Concepts |
| retire\_reason | varchar(255) | Specifies the reason due to which this drug was removed from the list of active referable Concepts |
| uuid | char(38) | Auto-fill unique identifier identifying this record in the table on this particular machine. It is unique across all implementations for the creator of the row. |

(Fig. 1.1 - Bahmni - Concept table)

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| **drug** |
|  **Field Name** | **Data Type** | **Description** |
| drug\_id | integer(10) | Unique internal number identifying a specific drug formulation |
| concept\_id | concept.concept\_id | The Concept ID which defines the generic ingredient(s) or precise ingredient for the drug formulation |
| name | varchar(255) | The specific drug formulation including brand/generic name, strength and form. |
| combination | bit | Specifies if the drug is composed of two or more active pharmaceutical ingredients |
| dosage\_form | concept.concept\_id | The form in which the drug is consumed (Powder, Tablet, Syrup, Injection, etc.) |
| maximum\_daily\_dose | double(22) | Maximum dose of drug consumption that can be prescribed on a daily basis |
| minimum\_daily\_dose | double(22) | Minimum dose of drug consumption that can be prescribed on a daily basis |
| route | concept.concept\_id | The route by which the patient consumes the drug (Oral, Injection, etc.) |
| creator | users.user\_id | Specifies the Person ID of the person who recorded this Concept drug in the system - Administrator |
| date\_created | timestamp(19) | Specifies the Date on which the drug was recorded / defined in the system |
| retired | bit | Specifies if this Drug is allowed to be ordered through the system, i.e. if it is/is not active in circulation |
| retired\_by | users.user\_id | Specifies the Person ID of the person who removed this Drug Concept from the list of orderable drugs - Administrator |
| date\_retired | timestamp(19) | Specifies the Date on which the drug Concept was removed from the list of orderable drugs |
| retire\_reason | varchar(255) | Specifies the reason for removing this drug from the list of orderable drugs |
| uuid | char(38) | Auto-fill unique identifier identifying this record in the table |
| date\_changed | timestamp(19) | Specifies the Date on which the set drug composition fields were edited or the record was removed from the ‘Active’ Concept Drug list |
| changed\_by | users.user\_id | Specifies the Person ID of the Person who last edited the default drug composition field values - Administrator |
| strength | varchar(255) | Specifies the strength of the formulary (e.g. 100 mg) |

(Fig. 1.2 - Bahmni - Drug table)

Drug Ingredient table contains data about the ingredients which make up one drug.

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| **drug\_ingredient** |
|  **Field Name** | **Data Type** | **Description** |
| drug\_id | drug.drug\_id | Unique number identifying a drug |
| ingredient\_id | concept.concept\_id | Unique number identifying an ingredient which the drug is composed of |
| uuid | char(38) | Auto-fill unique identifier identifying the record in the table |
| strength | double(22) | Strength of the formulary (Value-Units, e.g. ‘5’ in 5 mg) of the ingredient in the drug |
| units | concept.concept\_id | Unit corresponding to the strength of the formulary (mg, ml, etc.) |

(Fig. 1.3 - Bahmni - Ingredients table)

The Drug Order table stores data about the elements associated with the drug order.

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| **drug\_order** |
|  **Field Name** | **Data Type** | **Description** |
| order\_id | orders.order\_id | Unique number identifying a Drug Order |
| drug\_inventory\_id | drug.drug\_id | Unique identifier corresponding to the inventory which this drug is a part of |
| dose | double(22) | A number signifying the strength of the drug (e.g. ‘100’ in 100 ml) |
| as\_needed | bit | Specifies the value set corresponding to a checkmark on the UI that Indicates that the drug only needs to be consumed 'as needed' |
| dosing\_type | varchar(255) | Specifies the fields that are active on the UI form - Standard field values corresponding to standard composition parameters or Free text instructions typed by the Physician on orders |
| quantity | double(22) | Specifies the number signifying the quantity of a drug to be dispensed (e.g. 1, 2.5, 3…) |
| as\_needed\_conditions | varchar(255) | Specifies the conditions during which the Patient is allowed to consume this drug (Free Text) |
| num\_refills | integer(10) | Specifies the number of times the order can be renewed or refilled for the drug to be dispatched/administered to the Patient |
| dosing\_instructions | long varchar(65535) | Specifies free text instructions for the Patient for consuming the drug |
| duration | integer(10) | Specifies the Duration for which the drug needs to be dispensed to the patient (3, 5, 10 (days)) |
| duration\_units | concept.concept\_id | Specifies the Units corresponding to duration for which the patient is given the drug (Days, Hours) |
| quantity\_units | concept.concept\_id | Specifies the Units corresponding to the quantity of medicines given to the patient (e.g. 2 Units of 50 mg of Drug) |
| route | concept.concept\_id | Specifies the route by which the patient is administered the drug (Oral, Injection, Ointment) |
| dose\_units | concept.concept\_id | Specifies the Units corresponding to the dose which signifies the strength of the drug (e.g. mg, ml, etc.) |
| frequency | order\_frequency.order\_frequency\_id | Specifies the frequency at which the patient needs to consume the drug (e.g. 7 days/week, 2 times/day etc.) |
| brand\_name | varchar(255) | Specifies the brand or generic name by which the drug is commonly identified |
| dispense\_as\_written | bit | Indicates if the drug is to be dispensed as explicitly specified in the instructions |

(Fig. 1.4 - Bahmni - Drug Order table)

The Drug Reference Map table stores information with respect to inclusion or removal of the Drug Concept and the related terms or other vocabularies from the system.

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| **drug\_reference\_map** |
|  **Field Name** | **Data Type** | **Description** |
| drug\_reference\_map\_id | integer(10) | Unique number identifying the reference of the Drug mapped to other concepts (e.g. can get the list of retired drugs this drug is associated with) |
| drug\_id | drug.drug\_id | Unique number identifying the Drug |
| term\_id | concept\_reference\_term.concept\_reference\_term\_id | Unique identifier for the Term to which the Drug Concept is mapped to |
| concept\_map\_type | concept\_map\_type.concept\_map\_type\_id | Specifies the unique identifier for the type of mapping between the drug and the other concept |
| creator | users.user\_id | Specifies the Person ID of the Person who created this definition - Administrator |
| date\_created | timestamp(19) | Specifies the Date on which the reference definition was recorded in the system |
| retired | bit | Bit signifying if this reference is active or not in the system |
| retired\_by | users.user\_id | Specifies the Person ID of the Person who removed this reference from the list of active references - Administrator |
| date\_retired | timestamp(19) | Specifies the Date on which the reference was removed from the list of active references |
| retire\_reason | varchar(255) | Specifies the Reason why this reference was removed from the list of active references |
| changed\_by | users.user\_id | Specifies the Person ID of the Person who last edited the definition or a field corresponding to this reference - Administrator |
| date\_changed | timestamp(19) | Specifies the Date on which the definition or a value corresponding to this reference was last edited |
| uuid | char(38) | Auto-fill unique identifier identifying this record in the table |

(Fig. 1.5 - Bahmni - Drug Reference table)

**DATA MODEL**

In this section, we will see the design and analysis of the proposed module’s data model.

Refer Data Dictionary on the following pages for the descriptions.





The Drug Order table represents all the parameters associated with an individual drug order. With reference to the wireframes for Individual Drug Orders, each field pertaining to drug composition or drug consumption details will be unique to that order and must be stored with suitable references to the Drug Order ID. It is also required to note the indication of the drug being or not being allergic to the patient and the reasons to order an allergic drug. It will also include the fields to store the Order status (fulfilled/held for approval/discontinued etc.)

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|  **Drug Order** |
|
| **Field Name** | **Data Type** | **Description** |
| drug\_order\_id | ORDER.ORDER\_ID | Unique number identifying the order |
| drug\_id | DRUG.DRUG\_ID | Commonly recognized Drug Name |
| dose | DOUBLE(22) | Value indicating the strength of the Drug (e.g. 100 in 100 mg of drug name) |
| dose\_units | CONCEPT.CONCEPT\_ID | Specifies the unit of measurement (mg, ml etc.) |
| frequency | CONCEPT.CONCEPT\_ID | Specifies the Frequency of consumption (e.g. 7 days/week, 2 times/day etc.) |
| route | CONCEPT.CONCEPT\_ID | Specifies the Route of consumption (Oral, Injection) |
| duration | INTEGER(10) | Specifies the Duration of consumption (6 in 6 days) |
| duration\_units | CONCEPT.CONCEPT\_ID | Specifies the Duration Units (days, hours etc.) |
| quantity | INTEGER(10) | Specifies the Quantity (a number) of consumption  |
| start\_date | TIMESTAMP(10) | Specifies the Start Date from which the Patient has to consume this drug |
| person\_id | PERSON.PERSON\_ID | Specifies the Person ID of the Person for whom drug is being ordered – Patient ID |
| drug\_is\_allergic | BIT | Indicates if the drug is allergic or not for the patient |
| is\_allergic\_order\_reasons | VARCHAR(255) | Specifies the reason to order a drug despite knowing that the Patient is allergic to it |
| associated\_diagnosis | VARCHAR(65535) | Specifies the description of the diagnosis on the basis of which this drug is prescribed |
| patient\_instructions | VARCHAR(65535) | Instructions given by the Physician to the Patient |
| pharmacy\_instructions | VARCHAR(65535) | Instructions given by the Physician to the Pharmacist |
| order\_status | CONCEPT.CONCEPT\_ID | Indicates the status of the order - fulfilled, cancelled, held for approval etc. |
| discontinued | BIT | Indicates if this order has been discontinued |
| discontinuation\_reasons | VARCHAR(255) | Specifies the reasons to discontinue an order |
| approval\_required | BIT | Indicates whether senior Physician’s approval is required to prescribe this drug to the Patient |

(Fig 3.1 – Drug Order Table)

The DRUG table stores drug specific information including the name of the drug as well as the manufacturer’s brand name to uniquely identify the drug.

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| **Drug** |
|
| **Field Name** | **Data Type** | **Description** |
| drug\_id | INTEGER(10) | Unique number identifying the Drug |
| drug\_name | VARCHAR(255) | Commonly recognized name of the Drug |
| brand\_name | VARCHAR(255) | Name of the manufacturing brand of the Drug |

(Fig 3.2 – Drug Table)

The DISEASE PLAN ORDER table represents the pre-defined medication plan Orders associated with a patient. Each Order corresponds to a disease. In the case of a pre-defined medication plan, the order for a plan will have a specific Start Date for all the drugs that are being ordered as a set to treat this disease.

Given that the Physician may choose to discontinue a plan, relevant fields are provided.

|  |
| --- |
| **Disease Plan Order** |
|
| **Field Name** | **Data Type** | **Description** |
| disease\_plan\_order\_id | ORDER.ORDER\_ID | Unique number identifying the Disease Plan Order |
| disease\_name | VARCHAR(255) | Commonly identified name of the Disease |
| person\_id | PERSON.PERSON\_ID | Specifies the Person ID of the Person for whom the drug is being ordered - Patient |
| start\_date | TIMESTAMP(10) | Specifies the Start Date of medication |
| disease\_plan\_order\_status | CONCEPT.CONCEPT\_ID | Indicates the status of the order – whether fulfilled, discontinued, cancelled etc. |
| discontinued | BIT | Specifies whether this plan has been discontinued or is still active / being fulfilled |
| discontinuation\_reasons | VARCHAR(255) | Specifies the reasons to discontinue an active plan |
| approval\_required | BIT | Indicates whether senior physician’s approval is required for the drug to be prescribed to the Patient (for the Order to be placed) |

(Fig 3.3 – Disease Plan Order Table)

Each order (Disease plan) has several individual drug Orders associated with it and that is represented in the Disease Drug List table.

The DISEASE DRUG LIST table provides a mapping of a disease with the drugs which are defined to be a part of the disease treatment medication plan. A disease may have one or more drugs prescribed as a part of the treatment plan, and every individual drug being prescribed as a part of the plan contains its own Drug Order table entry.

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| **Disease Drug List** |
|
| **Field Name** | **Data Type** | **Description** |
| disease\_drug\_list\_id | INTEGER(10) | Unique number identifying the Disease Drug List record ID |
| drug\_order\_id | DRUG\_ORDER.DRUG\_ORDER\_ID | Unique Drug Order ID of the drug which is a part of the list of drugs being ordered in the disease treatment plan |
| disease\_plan\_order\_id | DISEASE\_PLAN\_ORDER.DISEASE\_PLAN\_ORDER\_ID | Unique number identifying the disease for which the given drug is pre-defined to be ordered as a treatment plan |

(Fig 3.4 – Disease Drug Table)

The PHARMA ORDER table provides a record of components or fields filled in by the Pharmacist while taking an action on an Order – Dispatch, Put it on Hold, Cancel. These are additional fields associated with each approved or placed Order.

The fields pertaining to comments and messages are optional and will be filled by the Pharmacist. This table has a one-to-one relationship or corresponding record with the Drug Order table but for simplicity, we will store them separate.

We have 2 separate comment fields since the Pharmacist may choose to make a note for the record and may or may not have another message for the ordering physician.

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| **Pharma Order** |
|
| **Field Name** | **Data Type** | **Description** |
| pharma\_order\_id | INTEGER(10) | Unique Pharma Order ID |
| drug\_order\_id | ORDER.ORDER\_ID | Reference to the corresponding Drug Order ID |
| pharma\_comments | VARCHAR(65535) | Pharmacist's comments upon taking an action |
| forward\_comments | BIT | Bit indicating if the Pharmacist’s comments is to be forwarded to the ordering physician |
| send\_new\_message | BIT | Bit indicating if the Pharmacist wants to send a separate message to the ordering physician |
| new\_message | VARCHAR(65535) | Pharmacist's message to the Physician |

(Fig 3.5 – Pharma Order Table)