AHCCCS Search Engine

Logical Design

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AHCCCS

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Logical Design Summary

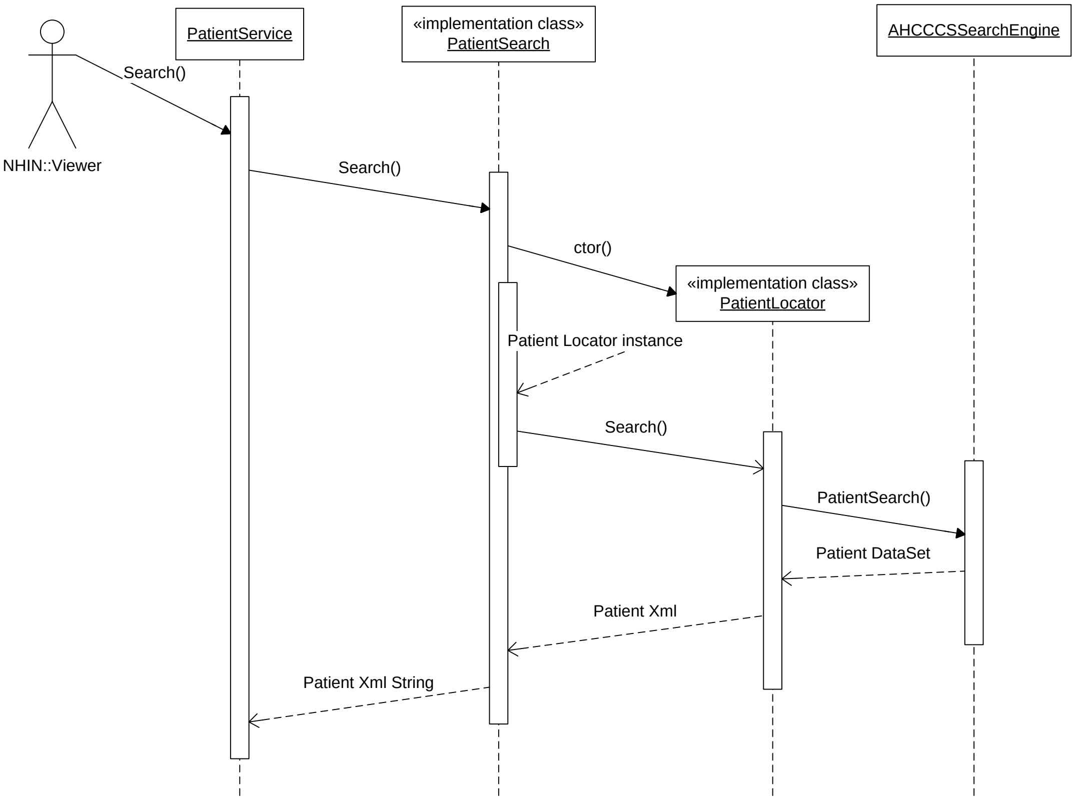
This document describes the logical design for the AHCCCS Search Engine. The AHCCCS Search Engine stores the consolidated list of patients derived from the RLS system and provide the necessary interfaces to publish to the engine data store and query for patient lists and patient record descriptors.

Logical Process Narratives

Patient Search

The patient search will be initiated through the **Patient Service Web Service** exposed by the NHIN Directory. A user will pass an XML string containing search parameters to the **Patient Service Web Service**. The **Patient Service Web Service** will pass the provided search XML to the **Patient Search Orchestration** as an XML document. The **Patient Search Orchestration** will construct a **Patient Locater Message** with the given XML document. The **Patient Locater Message** will extract the search parameters from the XML document, determine the best search behavior to invoke, and invoke the corresponding **AHCCCS Search Engine Data Access Layer** method. The **AHCCCS Search Engine Data Access Layer** will invoke a SQL stored procedure.

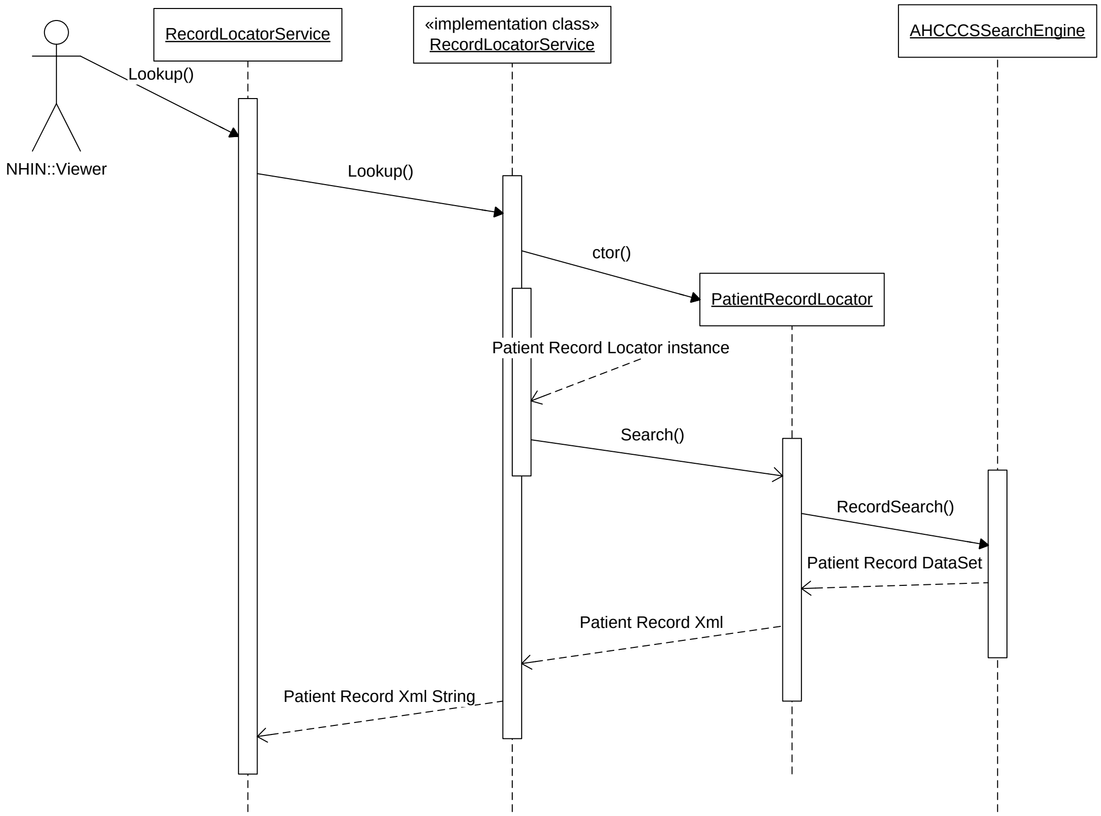
The SQL stored procedure will query a **patient key** data table, a **patient demographic** data table, and a **patient other** identifying information data table and return a distinct list of **patients** to the **AHCCCS Search Engine Data Access Layer**. The **AHCCCS Search Engine Data Access Layer** will accumulate the returned records into a single dataset and return the dataset to the **Patient Locater Message**. The **Patient Locater Message** will convert the dataset into a formatted XML document and return the XML document to the **Patient Search Orchestration**. The **Patient Service Orchestration** will convert the XML document to an XML string and return the XML string to the **Patient Service Web Service.**



Patient Record Search

The patient record search will be initialed through the **Record Locator Service Web Service** exposed by the NHIN Directory. A user will pass an XML string containing search parameters to the **Record Locator Service Web Service**. The **Record Locator Service Web Service** will pass the search XML to the **Record Locator Orchestration**. The **Record Locator Orchestration** will identify the search as an AHCCCS Search Engine search. The **Record Locator Orchestration** will construct a **Patient Record Locator Message** with the given XML document. The **Patient Record Locator Message** will extract the search parameters from the XML document and invoke the corresponding **AHCCCS Search Engine Data Access Layer** method. The **AHCCCS Search Engine Data Access Layer** will invoke a SQL stored procedure.

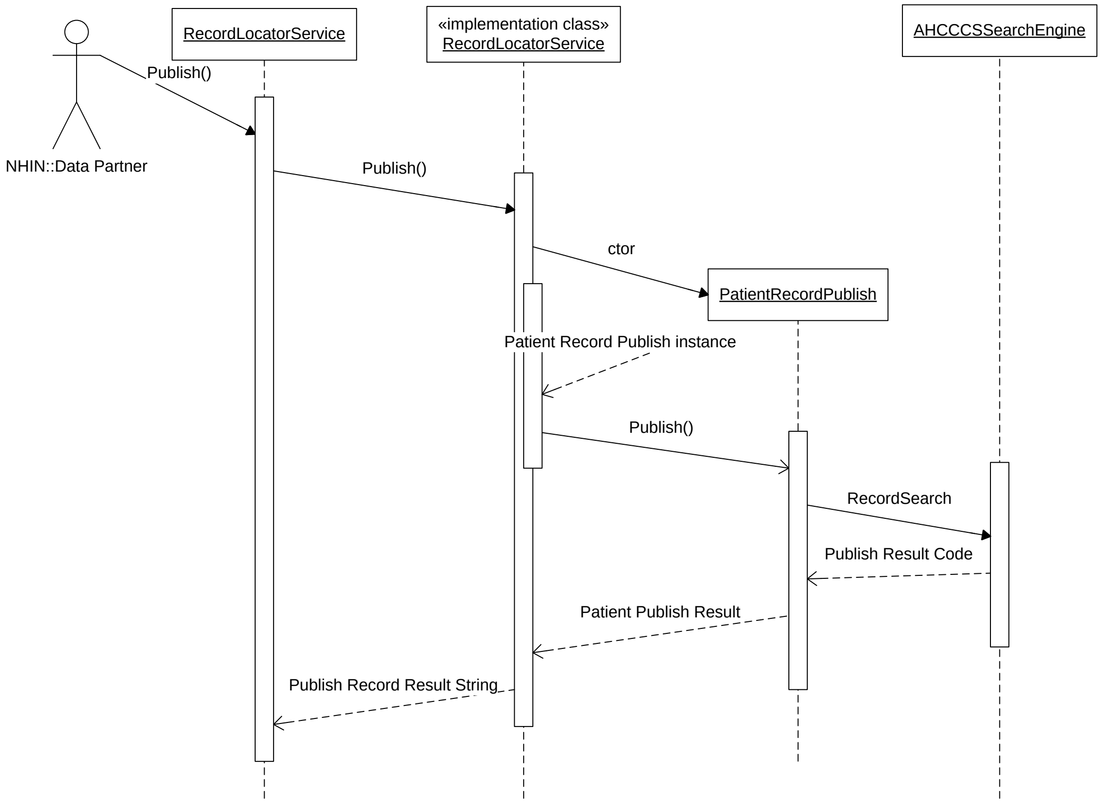
The SQL stored procedure will query the **patient to RLS cross reference** data table joined with the **RLS patient demographics** table and return a list of distinct patient record descriptors to the **Patient Record Locator Data Access Layer**. The **Patient Record Locator Data Access Layer** will accumulate the returned records into a single dataset and return the dataset to the **Patient Record Locator Message**. The **Patient Record Locator Message** will convert the dataset into a formatted XML document and return the XML document to the **Record Locator Orchestration**. The **Record Locator Orchestration** will return the XML document to the **Record Locator Service Web Service**.



Patient Record Publish

The patient record publish will be initiated through the **Record Locator Service Web Service** exposed by the NHIN directory. A user will pass an XML string containing the EMR for publish to the **Record Locator Service Web Service**. The **Record Locator Service Web Service** will pass the XML to the **Record Locator Orchestration**. The **Record Locator Orchestration** will save the EMR meta-data to the RLS data store. Then the **Record Locator Orchestration** will construct a **Patient Record Publish Message** with the EMR XML and the RLS meta-data key. The **Patient Record Publish Message** will extract specific patient meta-data from the EMR. The **Patient Record Publish Message** will invoke the corresponding **AHCCCS Search Engine Data Access Layer** method. The **AHCCCS Search Engine Data Access Layer** will invoke a SQL stored procedure.

The SQL stored procedure will attempt to match the **patient** meta-data with and existing **patient** based on **publish rules** and **rule keys**. The rule keys will be defined by **rule definitions**. If the meta-data matches, an entry will be made in the **patient to RLS cross reference** data table and possibly the **patient demographics** data table and a **patient other** identifying information data table. If no match, an entry will be made in the **patient**, **patient key**, **patient demographics**, **patient other** and **patient to RLS cross reference** data tables. Each publish stored the patient publish data in the **patient history** table.



Objects

The AHCCCS Search Engine will operate as both a component of the RLS system and as an interface for consolidated patient searches.

Web Services

Patient Service Web Service

The Patient Service web service is the public interface of the AHCCCS Search Engine's patient search. It will receive the initial request from the outside environment and will initiate a patient search.

Behaviors

Search

- Input Parameters
  - SenderId
    - String data type
    - Used to identify the sender of the request
  - SessionId
    - String data type
    - Used to identify the session of the request
  - Data
    - String data type containing valid HL7 version 3 XML
    - XML containing search parameters

- Return Parameter
  - String data type containing valid HL7 version 3 XML
  - XML containing distinct patient list

Record Locator Service Web Service

The Record Locator Service is outside the scope of the AHCCCS Search Engine.

Orchestrations

Patient Search Orchestration

The Patient Search Orchestration will examine and validate the incoming for request from the Patient Web Service. If the request is determined to be valid, the orchestration will create a Patient Locator Message and execute the search method. In addition, the orchestration will be responsible for auditing requests and responses.

Behaviors

Search

- Input Parameters
  - SenderId
    - String data type
    - Used to identify the sender of the request
  - SessionId
    - String data type
    - Used to identify the session of the request
  - RequestDocument
    - System.Xml.XmlDocument data type
    - XmlDocument containing search parameters
- Return Parameter
  - System.Xml.XmlDocument data type
  - XmlDocument containing distinct patient list

Record Locator Orchestration

The Record Locator Orchestration is outside the scope of the AHCCCS Search Engine.

Messages

Patient Locater Message

The Patient Locater Message object will parse the provided request and extract the search parameters. Based on the provided parameters, the Patient Locator Message will invoke the best AHCCCS Search Engine Data Access Layer's *PatientSearch* method. The Patient Locator Message will then convert the returned dataset into a valid return message.

Behaviors

Constructor

- Input Parameter
  - RequestDocument
    - System.Xml.XmlDocument data type
    - XmlDocument containing search parameters

Search

- Return Parameter
  - System.Xml.XmlDocument data type

- XmlDocument containing distinct patient list

Patient Record Locator Message

The Patient Record Locator Message object will parse the provided request and extract the search parameters. The Patient Record Locator message will invoke the AHCCCS Search Engine Data Access Layer *RecordSearch* method. The Patient Record Locator Message will then convert the returned dataset into a valid return message.

Behaviors

Constructor

- Input Parameter
    - RequestDocument
        - System.Xml.XmlDocument data type
        - XmlDocument containing search parameters

Search

- Return Parameter
    - System.Xml.XmlDocument data type
    - XmlDocument containing distinct patient list

Patient Record Publish Message

The Patient Publish Message object will parse the provided EMR and extract the patient meta-data. The Patent Publish Message will invoke the AHCCCS Search Engine Data Access Layer *Publish* methods.

Behaviors

Constructor

- Input Parameter
    - RequestDocument
        - System.Xml.XmlDocument data type
        - XmlDocument containing EMR
    - RLS PatientKey
        - Integer data type
        - Key for RLS meta-data for this EMR

Publish

- Return Parameter
    - Integer data type
    - A flag indicator of how the EMR was handled
        - Bit 1
            - On – New patient
            - Off – Existing patient
        - Bit 2
            - On – New Alias
            - Off – Existing alias
        - Bit 3
            - On – New Other Identifying information
            - Off – No New Other Identifying Information
        - Bit 4
            - On – New RLS Record
            - Off – Existing RLS Record
        - Bit 5
            - On – Exception Occurred
            - Off – Publish Successful

Data Access

AHCCCS Search Engine Data Access Layer

The Patient Locator Data Access Layer provides a set of methods for looking up a patient, a patient’s records, and publishing new/existing patient’s EMR’s.

Behaviors

PatientSearch

- Input Parameters - Overload 1
    - AHCCCS ID
        - String data type
        - The patient’s AHCCCS Id
        - Required
    - Last Name
        - String data type
        - The patient’s last name
        - Can be null
    - Last Name Complete
        - Boolean data type
        - Indicator if the Last Name parameter is complete
        - Required
    - Date of Birth
        - Nullable date data type
        - The patient’s date of birth
        - Can be null
- Input Parameters - Overload 2
    - Last Name
        - String data type
        - The patient’s last name or partial last name
        - Can be null
    - Last Name Complete
        - Boolean data type
        - Indicator if the Last Name parameter is complete
        - Required
    - First Name
        - String data type
        - The patient’s first name or partial first name
        - Can be null
    - First Name Complete
        - Boolean data type
        - Indicator if the First Name parameter is complete
        - Required
    - Date of Birth
        - Nullable date data type
        - The patient’s date of birth
        - Can be null
    - Gender
        - String data type
        - The patient’s gender
        - Can be null
- Input Parameters – Overload 3
    - Last Name
        - String data type
        - The patient’s last name or partial last name

        - Can be null
    - Last Name Complete
        - Boolean data type
        - Indicator if the Last Name parameter is complete
        - Required
    - First Name
        - String data type
        - The patient’s first name or partial first name
        - Can be null
    - First Name Complete
        - Boolean data type
        - Indicator if the First Name parameter is complete
        - Required
    - Date of Birth
        - Nullable date data type
        - The patient’s date of birth
        - Can be null
    - Gender
        - String data type
        - The patient’s gender
        - Can be null
    - Middle Initial
        - String data type
        - The patient’s middle initial
        - Can be null
    - SSN
        - String data type
        - The last 4 digits of the patient’s social security number
        - Can be null
    - Insurance Id
        - String data type
        - The patient’s insurance id
        - Can be null
    - MRN
        - String data type
        - A medical record number that the patient’s information may be stored under
        - Can be null
    - Street Address
        - String data type
        - A string to perform pattern matching against the actual patient’s address
        - Can be null
    - City
        - String data type
        - The city that the patient resides in
        - Can be null
    - Postal Code
        - String data type
        - A patient’s postal code
        - Can be null
- Return Parameter
    - System.Data.DataSet data type
    - Dataset with the patient entries

RecordSearch

- Input Parameters
    - AHCCCS Search Id
- Return Parameter
    - System.Data.DataSet data type
    - Dataset with the patient records descriptors

Publish

- Input Parameters
    - Last Name
        - String data type
        - The patient’s last name or partial last name
        - Required
    - First name
        - String data type
        - The patient’s first name or partial first name
        - Required
    - Date of Birth
        - Date data type
        - The patient’s date of birth
        - Required
    - Gender
        - String data type
        - The patient’s gender
        - Required
    - Middle Initial
        - String data type
        - The patient’s middle initial
        - Required
    - SSN
        - String data type
        - The last 4 digits of the patient’s social security number
        - Optional
    - Insurance Id
        - String data type
        - The patient’s insurance id
        - Optional
    - MRN
        - String data type
        - A medical record number that the patient’s information may be stored under
        - Required
    - Street Address
        - String data type
        - A string to perform pattern matching against the actual patient’s address
        - Optional
    - City
        - String data type
        - The city that the patient resides in
        - Optional
    - Postal Code
        - String data type
        - A patient’s postal code
        - Required

Key Definition

A Key Definition will define a single attribute of a patient. For example, there will be a key definition for AHCCCS Id, First name, gender, postal code. Furthermore, the definition will store the priority level of the key. The priority level of the key will determine whether the patient attribute is stored in the patient key, demographic, or other table.

Attributes

KeyDefinition	
PK	**KeyDefinitionId**
- - -	**Description** **Priority** **CreateDate**

- KeyDefinitionId
  - Automatically assigned by the system
  - Integer data type
  - Required field
  - Primary key
- Description
  - The descriptive name of the key
  - Variable length ASCII character field
  - Required field
- Priority
  - The level of importance of the key
  - Integer data type
  - Required field
- CreateDate
  - Defaults to the initial date/time when the entry is first created
  - Date/Time field
  - Required field

Patient

A Patient object will store the primary patient id for a single patient and the status of this patient entry. This table is the key parent table to all of a patient's information. It will also store when a patient entry has been repudiated.

Attributes

Patient	
PK	**PatientId**
	Status **CreateDate** RepudiateDate

- PatientId
  - Automatically assigned by system
  - Integer data type

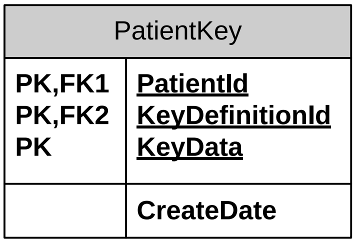
- Required field
- Primary key

- Status
  - Defaults to 1 when entry is first created
  - Integer field
  - Required field
  - Will change to 0 when the entry is repudiated and will no longer be searchable
- CreateDate
  - Defaults to the initial date/time when the entry is first created
  - Date/Time field
  - Required field
- RepudiateDate
  - Will store when the patient record is repudiated
  - Defaults to NULL
  - Date/Time field

Patient Key

A Patient Key object will store a patient's priority level one data, which is the most probable unique identifier for a patient. For the purposes of this implementation, the key data will be defined as a patient's AHCCCS Id number.

Attributes



PatientKey	
PK,FK1 **PK,FK2** **PK**	**PatientId** **KeyDefinitionId** **KeyData**
	CreateDate

- PatientId
  - Assigned by system with the corresponding patient objects index
  - Integer field
  - Required field
  - Primary Key
- KeyDefinitionId
  - Assigned by the system with the corresponding key definition id
  - Integer field
  - Required field
  - Primary Key
- KeyData
  - A patients priority one key attribute information
  - Variable length Unicode character field to support extended character sets
  - Required field
- CreateDate
  - Defaults to the initial date/time when the entry is first created
  - Date/Time field
  - Required field

Patient Demographics

A Patient Demographics object will store a patient's priority level two data. The priority two data will be the patient first name, last name, gender, date of birth.

Attributes

PatientDemographics	
PK,FK1 **PK,FK2** **PK**	**PatientId** **KeyDefinitionId** **KeyData**
	CreateDate

- PatientId
    - Assigned by system with the corresponding patient objects index
    - Integer field
    - Required field
    - Primary Key
- KeyDefinitionId
    - Assigned by the system with the corresponding key definition id
    - Integer field
    - Required field
    - Primary Key
- KeyData
    - A patients priority two key attribute information
    - Variable length Unicode character field to support extended character sets
    - Required field
- CreateDate
    - Defaults to the initial date/time when the entry is first created
    - Date/Time field
    - Required field

Patient Other

A Patient Demographics object will store a patient's priority level three data. The priority three data will be the patient's address, medical record number, insurance id, etc.

Attributes

PatientOther	
PK,FK1 **PK,FK2** **PK**	**PatientId** **KeyDefinitionId** **KeyData**
	CreateDate

- PatientId
    - Assigned by system with the corresponding patient objects index
    - Integer field
    - Required field
    - Primary Key
- KeyDefinitionId
    - Assigned by the system with the corresponding key definition id
    - Integer field
    - Required field
    - Primary Key
- KeyData
    - A patients priority three key attribute information
    - Variable length Unicode character field to support extended character sets

    - Required field
- CreateDate
    - Defaults to the initial date/time when the entry is first created
    - Date/Time field
    - Required field

Patient-RLS Cross-reference

A Patient-RLS Cross-reference object will store a patient's RLS record keys.

Attributes

PatientRLS	
PK,FK1 **PK**	**PatientId** **PatientKey**
	CreateDate

- PatientId
    - Assigned by system with the corresponding patient objects index
    - Integer field
    - Required field
    - Primary key
- PatientKey
    - Populated from the RLS parameter
    - Integer field
    - Required Field
    - Primary key
- CreateDate
    - Defaults to the initial date/time when the entry is first created
    - Date/Time field
    - Required Field

Patient Link

A Patient Link object will store possible matches between two records that do not satisfy the publish rules for an exact match, but has a total weight more than a Publish Rule's LinkThreshold setting.

Attributes

PatientLink	
PK,FK1 **PK,FK2**	**PatientId1** **PatientId2**
	Weight **CreateDate**

- PatientId1
    - Assigned by system with the corresponding patient objects index
    - Integer field
    - Required field
    - Primary key
- PatientId2
    - Assigned by system with the corresponding patient objects index

  - Integer field
  - Required field
  - Primary key
- Weight
  - The weight assigned by the system that resulting in the patients being linked
  - Date/Time field
  - Required Field
- CreateDate
  - Defaults to the initial date/time when the entry is first created
  - Date/Time field
  - Required Field

Publish Rule

A Publish Rule object stores a publish business rule. Each entry in this table will define a rule that will be applied to incoming patients to decide whether or not the incoming patient is a duplicate or a new patient entry. Furthermore, the link threshold will allow linking two patient records that satisfy the link threshold setting.

Attributes

PublishRule	
PK	**PublishRuleId**
	Description **LinkThreshold** **Active** **CreateDate**

- PublishRuleId
  - Automatically assigned by system
  - Integer data type
  - Required field
  - Primary key
- Description
  - The descriptive name of the rule
  - Variable length character data
  - Required field
- LinkThreshold
  - The level at which a patient is linked to another. A link threshold of 100, will effectively never link based on this rule.
  - Integer data type
  - Required Field
- Active
  - Toggles this rule on or off for publish matching
  - Boolean data type
  - Required field
  - Defaults to true
- CreateDate
  - Defaults to the initial date/time when the entry is first created
  - Date/Time field
  - Required Field

Publish Rule Keys

A Publish Rule Key object defines a single piece of key attribute data the must equal to satisfy part of the parent Publish Rule. In addition, it assigns a weight to this field for possible linking. The weights of all the publish rule keys for an individual publish rule will add up to 100.

Attributes

PublishRuleKeys	
PK,FK1 **PK,FK2**	**PublishRuleId** **KeyDefinitionId**
	Nullable **EnforceEquality** **Weight** **CreateDate**

- PublishRuleId
  - Assigned by the system corresponding to the parent publish rule
  - Integer data type
  - Required field
  - Primary key
- KeyDefinitionId
  - Assigned by the system corresponding to the parent key definition
  - Integer data type
  - Required field
  - Primary key
- Nullable
  - Flag as to whether the patient key attribute can be null and still satisfy this rule key
  - Boolean data type
  - Required field
- EnforceEquality
  - Flag as to whether the patient key attribute has to equal and still satisfy this rule key, excluding null.
- Weight
  - This individual patient key attribute contribution to the overall parent match
  - Integer data type
  - Required field
- CreateDate
  - Defaults to the initial date/time when the entry is first created
  - Date/Time field
  - Required Field

Patient History

A Patient history object stores the original information published to the AHCCCS Search Engine. This history can be used to regenerate the index if the business rules change.

Attributes

PatientHistory	
PK	**<u>PatientHistoryId</u>**
	PatientKey AHCCCSID FirstName MiddleInitial LastName Gender DateOfBirth Address1 Address2 City State PostalCode InsuranceId MRN SSN **CreateDate**

- PatientHistoryId
  - Automatically assigned by the system
  - Integer data type
  - Required field
  - Primary Key
- PatientKey
  - Data published as the RLS Paitnet key
  - Integer data type
  - Required field
- AHCCCSID
  - The published AHCCCS id
  - Variable length ASCII string
- FirstName
  - The published first name
  - Variable length Unicode data
- MiddleInitial
  - The published middle initial
  - Variable length Unicode data
- LastName
  - The published last name
  - Variable length Unicode data
- Gender
  - The published gender
- DateOfBirth
  - The published date of birth
  - Date/Time data type
- Address1
  - The published address line 1
  - Variable length ASCII string
- Address2
  - The published address line 2
  - Variable length ASCII string

- City
  - The published city
  - Variable length ASCII string
- State
  - The published state
  - Variable length ASCII string
- PostalCode
  - The published postal code
  - Variable length ASCII string
- InsuranceId
  - The puiblished insurance id
  - Variable length ASCII string
- MRN
  - The published MRN
  - Variable length ASCII string
- SSN
  - The published SSN
  - Variable length ASCII string
- CreateDate
  - Defaults to the initial date/time when the entry is first created
  - Date/Time field
  - Required Field

Relationships

A **key definition** object is a parent object and has no parent relationship. A **key definition** can have zero or more **patient key** entries, zero or more **patient demographic** entries, zero or more **patient other** entries, and zero or more **publish rule keys** entries.

A **patient** object is a master object and has no parent relationship. The **patient** object will have zero or more **patient key** entries, zero or more **patient demographics** entries, zero or more **patient other** entries, and zero or more **patient link** entries. A **patient** object will have one or more **patient-RLS** cross-referencing objects.

A **publish rule** object is a parent object and has no parent relationship. A **publish rule** will have at least one **publish rule key** entry and may have more than one **publish rule key** entry.

A **patient key** object will have exactly one parent **patient** object and exactly one parent **key definition** object.

A **patient demographics** object will have exactly one parent **patient** object and exactly one parent **key definition** object.

A **patient other** object will have exactly one parent **patient** object and exactly one parent **key definition** object.

A **patient link** object will have exactly two parent **patient** objects.

A **patient-RLS** object will have exactly on parent patient object.

A **publish rule key** object will have exactly one parent **publish rule** object and exactly one parent **key definition** object.