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HL7 Version 3 Domain Analysis Model: Immunization, Release 1

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Foreword

Publication of this document that has been registered as a Technical Report with ANSI has been approved by Health Level Seven International (HL7), 3300 Washtenaw Avenue, Suite 227, Ann Arbor, MI 48104-4261. This document is registered as a Technical Report according to the Procedures for the Registration of Technical Reports with ANSI. This document is not an American National Standard and the material contained herein is not normative in nature. Comments on the content of this document should be sent to the HL7 Public Health and Emergency Response Work Group 3300 Washtenaw Avenue, Suite 227, Ann Arbor, MI 48104-4261 or hq@hl7.org.

Introduction

Immunization is an important component of preventive health care. Immunization information may be found on many different health information systems. Successful interoperable communication between these systems is required to optimize timely and appropriate immunization. HL7 has developed a number of artifacts, which support this interoperability. These include Version 2 Implementation Guides, Version 3 messages, services and documents. This DAM will provide a reference for mapping between these and facilitate support of the needs of the clinical community regarding immunization. Like immunization, public health is linked to many areas of health care the associated health information systems. For this reason, the Public Health and Emergency Response (PHER) work group is leading this effort to develop a Domain Analysis Model (DAM) of the broad range of areas related to immunization.

Scope

The PHER Immunization Domain Analysis Model is a UML model representing the structural and behavioral requirements of PHER sponsored projects in the immunization domain. It will illustrate the information and processing requirements of the immunization domain from a variety of perspectives. The DAM does not include information about vaccine development. Additionally, the product information pertaining to vaccination comes from the perspective of vaccine administration. Vaccine inventory management is in scope because it is a critical function of Immunization Information Systems (IIS). The sections that follow include:

- Storyboards that are intended to illustrate real-world scenarios in order to support identification of the actors and their goals related to immunization.
- Actors (entities involved in immunization)
- Domain Information Model, which documents the types of data, involved in immunization activities.
- Use Cases that further document the goals and actions involved in managing immunizations and immunization information.
- Activity Diagrams illustrate the workflow and interactions between systems.

Story Boards:

These storyboards were collected from a number of sources. Some are extracted and reformatted from the HL7 POIZ V3 Immunization Message specification (DSTU). Another group were developed with input from the American Immunization Registry Association (AIRA). The final group was extracted from requirements documents produced by Immunization Registry program in New South Wales, Australia. Our goal was to cast a wide net to assure that we had a view that reflects the wide range of immunization efforts. We realize that there is overlap between some storyboards, but feel that they enrich our view.

The storyboards we have collected are intended to illustrate both real-world scenarios and potential future scenarios. Some of these scenarios are true for one jurisdiction and not for others. Some scenarios cover similar activities but may be different. Our goal is to capture the actors and the activities in both situations so that we can assure that the DAM is able to be useful into the future.

These storyboards have not been modified to meet HL7 recommendations for names.

Record immunization history

Story Board:

Susan Q Public has moved from Portland, Maine to Augusta, Georgia. She brings her son to his new pediatrician on 1/1/2011. The clinic staff enters his demographic information into the office EHR and requests an immunization history from the State IIS. No record is found. Susan has a paper record from the previous pediatrician. The record includes the following:
Date of birth: Feb 2, 2009

Vaccine group	1	2	3	4	5
Hep B	2/2/2009	4/2/2009	8/3/2009		
DTAP	4/2/2009	8/3/2009			
Polio	4/2/2009	8/3/2009			
HIB	4/2/2009	8/3/2009			
Rotavirus					
MMR	2/1/2010				

Clinic staff enters this information into the EHR and transmits it to the State IIS. They request an evaluation of this history based on the ACIP schedule and request a forecast of what doses are due next from the State IIS. The State IIS returns an evaluated history and forecast of next doses due. They determine that they will administer a Pentacel (DTAP/HIB/IPV) dose, Lot number Q234sw in the right deltoid intramuscularly. The manufacturer is Sanofi Aventis. This administration is recorded in the EHR system. The EHR system transmits this to the IIS. The IIS incorporates this new information into its data store.

Actors:

- Clinician
- Patient
- Parent
- IIS

- EHR System

Actions/Interactions:

- Request patient records
- Record immunization history
- Transmit immunization history
- Request evaluation and forecast
- Receive immunization history

Concepts:

- Vaccination event
    - Lot number
    - Vaccine type
    - Vaccination date
    - Vaccine expiration date
    - Manufacturer
    -
- Patient/client
    - Patient identifiers
        - Id
        - Name
        - Date of birth
- Evaluated history
- Forecast
- ACIP schedule
- Historical immunization record

HIE Immunization Story Board

This HIE Immunization Story Board describes immunization registry reporting and data retrieval when a Health Information Exchange (HIE) serves as an intermediary between the provider system and the IIS

(immunization registry). The HIE contains a Public Health Gateway. The Public Health Gateway is a component of the HIE which is identified as having a special function within it. It serves as an intermediary between providers and public health. It simply pass messages through, or it may perform such services as routing, data caching, parsing, transformation, translation, and data quality checks.

In this use case, nothing is said about how the HIE assembles the information it uses to respond to provider queries. The HIE may query the IIS to obtain this information; alternatively it may cache immunization records in a document repository or other data store which it uses to respond to queries. Multiple HIEs or multiple IISs may also be involved. A submission or query may be routed or cascaded by the HIE as appropriate. For example, a regional HIE, failing to find a record locally, may query a state-wide HIE; a state-wide HIE may query an HIE in a neighboring state. These details and special cases are beyond the scope of this story board.

Step 1: An EHR queries the HIE for immunization information

The 4-year-old patient and the parent visit the provider, who uses an Electronic Health Record (EHR) system. Although the provider may have immunization records for the patient, his EHR nevertheless queries the Health Information Exchange (HIE) for the most up-to-date information. The HIE finds that the patient's records are available and returns the immunization history and care plan (sometimes called "vaccine forecast") to the EHR. The response may be in the form of a CDA, of an HL7 Version 2 message, or another format. The provider reviews the immunizations and the vaccine recommendation. The provider administers vaccines and enters the records in his EHR.

Step 2: The provider submits immunization records to the IIS via the HIE

The EHR submits the newly entered immunization records to the IIS via the HIE Public Health Gateway. The submission may be in the form of a CDA, an HL7 Version 2 message, or another format. The Public Health Gateway transforms the submission into HL7 Version 2 and updates the IIS.

Step 3: Another EHR queries the HIE for immunization information

In getting the child ready for school, the parent uses notices from his PHR that one vaccine is missing. In a rush, the parent makes an appointment at a different clinic. The patient is new to this provider. The EHR queries the Health Information Exchange (HIE) for the patient's immunization history and care plan. The HIE returns the immunization history and care plan to the EHR. The response may be in the form of a CDA, of an HL7 Version 2 message, or another format. The provider reviews the immunizations and the vaccine recommendation. The provider administers vaccines and enters the records in his EHR. Step 2 now repeats.

Actors:

- Provider
- Patient
- Parent
- EHR system
- HIE
- HIE Public Health Gateway
- IIS

Actions/Interactions:

- Request immunization history
- Return immunization history
- Request care plan
- Return care plan
- Submit immunizations to IIS

Vital Records Interface with IIS

Story Board:

Samuel Q. Public is born on 1/1/2011. The Birth Information Specialist enters Samuel's birth information into the jurisdiction's web-based Electronic Birth Registration System (EBRS). He receives a Hepatitis B immunization the following day in the newborn nursery. Although this is not a standard practice in the U.S., some jurisdictions capture newborn immunization information in their EBRS. Newborn nursery staff in this facility are authorized users of the EBRS. They pull up Samuel's record and add the immunization administration information, including the type of immunization, the lot number of the vaccine, the administration date and the individual who administered the vaccine. The birth record update is then saved.

Option 1:
Once the birth record is completed, the Birth Information Specialist releases the record to the jurisdiction's Vital Record Office for review and registration. Once VR receives and registers Samuel's birth (usually within 5 days), Samuel's immunization data and other vital records information including parent names, birth certificate number and address is extracted from the vital record data repository on a scheduled basis and transmitted via the State and Territorial Exchange of Vital Events (STEVE) System to the state immunization registry program. IIS staff extract the birth record from their STEVE mailbox and initiate a new record in the IIS for Samuel with the data provided by VR. Updates to birth records are transmitted on a routine basis to the Immunization Registry Program via STEVE. Samuel dies on 6/1/11 in this jurisdiction. A death record is registered and his birth record is matched and marked 'deceased.' Samuel's death record is transmitted via STEVE to the Immunization Registry mailbox. IIS staff update Samuel's immunization record status to 'permanently inactive.'

Option 2:
In this particular jurisdiction, the EBRS is linked to the state Immunization Information System (IIS). When the birth record is completed, the Birth Information Specialist releases the record to the jurisdiction's Vital Record Office for review and registration. Simultaneously, the EBRS transmits an electronic message to the IIS containing basic newborn identification information and the immunization record. The IIS automatically generates a new record for Samuel and populates it with these data. Samuel dies on 6/1/11. VR system automatically sends a fact of death notification to the IIS, indicating that Samuel is deceased. The IIS updates Samuel's immunization record status to 'permanently inactive.'

Actors:

- Electronic Birth Registration System
- IIS
- ERBS user

Actions/Interactions:

- Record birth data
- Record immunization record
- Send birth record
- Send immunization record
- Receive birth record
- Receive immunization record

Concepts:

- Vaccination event
    - Lot number
    - Vaccine type
    - Clinician
        - Ordering
        - Administering
- Patient/client
    - Patient identifiers
        - Id
        - Name
        - Date of birth
        - Mother's maiden name
    - Home address
    - Parents
        - Names
        - addresses
    - Birth state
    - Birthing facility
    - Birth registration number

- Death date

Vital Records Interface with IIS—Adoptions and Name Changes

Story Board:

Samuel Q Public was born on 1/1/2011. His birth and newborn immunization information were previously sent to the Immunization Information System (IIS). On 2/3/2011 he is legally adopted. His original record is sealed in the VR system and a replacement record is issued showing Samuel's adoptive name and his adoptive parents' information as shown on the court order. Following jurisdictional policy, the VR office electronically transmits key items from the replacement record to the IIS via the State and Territorial Exchange of Vital Events (STEVE) System. The IIS matches the replacement record with the original record using the State File Number, which is the unique identifier on the birth record that remains unchanged on the replacement record. The IIS changes the status of the original record to 'permanently inactive' and replaces the active record with the adoptive record data.

Actors:

- Electronic Birth Registration System
- IIS
- ERBS user

Actions/Interactions:

- Record adoption data
- Send adoption record
- Receive adoption record
- Update IIS records

Story Board:

Sally Public has a daughter on 2/3/2011. She has not decided on a name before she leaves the birth hospital. The birth hospital has recorded her name as Baby Girl Public in the EBRS. (Option 2) Her birth record is transmitted to the IIS without a full name. On 2/14/2011, Sally names her newborn Suzy Q by applying in the VR office for a name change. In this jurisdiction, the addition of a name to a birth record is treated as a correction instead of an amendment (requiring a court order) if added within 6 months of the birth. The VR clerk pulls up the registered birth record and accesses the correction function. The name change is entered and the record is saved. The EBRS records the name change from Baby Girl to Suzy Q. Sally Public pays for and is issued a new certification with the name of Suzy Q. Public for her baby daughter. The ERBS sends an updated record to the IIS with the new name via STEVE on a scheduled basis.

Actors:

- Electronic Birth Registration System
- IIS

- ERBS user
- Patient's mother

Actions/Interactions:

- Record birth data
- Send birth record
- Receive birth record
- Update IIS records
- Record update
- Send update
- Receive update

Concepts:

- Patient/client
    - Patient identifiers
        - Id
        - Name
        - Date of birth
        - Birth registration number
    - Patient address
- Birth parents
- Adoptive parents
- ERBS

Manage Vaccine Inventory

Story Board:

The inventory clerk of a state Immunization Information System (IIS) orders 1000 doses of MMR vaccine from the national distribution system (NDS). The order is received by the NDS. Vaccine is packaged and shipped. An electronic packing slip is sent to the IIS. When the IIS receives the vaccine, the inventory clerk examines the shipped vaccine and determines that it is all there and intact. He uses that electronic packing slip to update the IIS inventory system. (vaccine, lot number, expiration, number of doses)
A nurse in the state clinic administers a dose of MMR from this batch of vaccine and records this in the

IIS. The IIS updates the inventory management system, decrementing one dose.

The inventory clerk responds to a request from a local health department and transfers 10 doses to them. The IIS inventory management system subtracts the doses from the state inventory and adds it to the local public health inventory.

Actors:

- IIS system manager
- IIS System
- Inventory clerk

Actions/Interactions:

- Count doses used by vaccine
- Inventory management system is implied
- Transfer doses and inventory
- Accept inventory
- Record immunization
- Decrement inventory
- Increment inventory

Concepts:

- Vaccination event
    - Lot number
    - Vaccine type
    - Clinician
        - Ordering
        - Administering
- Inventory clerk
- Patient/client
    - Patient identifiers
        - Id
        - Name

        - Date of birth

- Vaccine distributor
- Packing slip (electronic)

Managing Publicly Funded Vaccine Inventory

Story Board:

Publicly funded vaccine usage must be tracked to assure appropriate usage and to forecast future needs. Some IIS require that clinics, which use EHR-S, provide supporting data when sending immunization records to the IIS. This storyboard describes some of the possible interactions, but should not be considered definitive.

My Local Clinic receives 100 doses publicly funded MMR vaccine from the distributor. The inventory clerk logs this into the EHR-S (including lot number, vaccine, expiration date). Later in the day, Bob Nurse administers one dose of MMR vaccine from this lot of publicly funded vaccine. He records this vaccination from that lot in the EHR-S. The EHR-S sends the update immunization history to the IIS. Included in this information is lot number and patient funding source for publicly funded vaccine. The record also includes information about the patient's eligibility for publicly funded vaccine. The IIS updates its records with this data.

At the end of the month, the IIS runs a report for My Local Clinic comparing the funding source and eligibility of all immunizations given at My Local Clinic for the month.

Actors:

Inventory clerk
EHR-S
IIS
Provider organization

Actions/Interactions:

Update inventory
Record immunization
Transmit immunization history
Create report

Concepts:

- Vaccination event
    - Lot number
    - Vaccine type
    - Clinician
        - Ordering
        - Administering

    - Funding source
    - Funding program eligibility
    - Administering clinic
- Patient/client
    - Patient identifiers
        - Id
        - Name
        - Date of birth
    - Patient address
    - Responsible adult
    - Registry status
- Vaccine distributor

Public Health Recall/Reminder

Story Board:

The Local Health Department is concerned because analysis shows the number of children in schools up to date for MMR is only 84%. They decide that they want to reach out to the parents of these children. They determine that they wish to send a post card to the parents for all children that are overdue for the MMR. They enter the reference date into the report request page and generate a set of mailing labels to be sent. Children who are contraindicated for MMR vaccine are not included in the recall. (In Immunization Information Systems, contraindications are recorded at the vaccine group level.) Children who have previously refused the vaccine are included in the recall.

Actors:

- Public health agency
- IIS
- CDS service

Actions/Interactions:

- Create report
    - Reminder letters
    - Request list of patients

        - Overdue on a date
        - Not contraindicated

Concepts:

- Vaccination event
    - Lot number
    - Vaccine type
    - Vaccination date
    - Vaccine group
    - Clinician
        - Ordering
        - Administering
        - Public health
- Patient/client
    - Patient identifiers
        - Id
        - Name
        - Date of birth
    - Patient address
    - Responsible adult
- Coverage report
- Recall/reminder
- Contraindication
-
-

Tracking funding program eligibility

Story Board:

George Pediatric, age 12, goes to MyClinic for a well child visit. The nurse reviews his immunization

history in the EHR system and notes that he is due for a Tdap vaccine. In addition, George's mother reports that they will be travelling to a country with a risk of yellow fever. After consulting with the travel specialist, the nurse administers a dose of Tdap and a dose of yellow fever vaccine. The nurse determines that George is Native American. The nurse records the child is eligible for vaccine funded by the Vaccines for Children (VFC) due to his being Native American. The Tdap vaccine is eligible for VFC funded vaccine, while the yellow fever vaccine is not. The nurse captures this in the EHR. The EHR sends the updated immunization history, including the eligibility status to the IIS. The IIS accepts the updated immunization history, tracking eligibility for each immunization.

Note that VFC is a US vaccine-funding program.
The IIS generates a report summarizing the number of immunization events where the patient qualified for VFC.

Actors:

Clinician
EHR-S
IIS
Patient

Actions/Interactions:

Record immunization
Transmit immunization history
Accept immunization history

Concepts:

- Vaccination event
    - Lot number
    - Vaccine type
    - Vaccination date
    - Clinician
        - Ordering
        - Administering
        - Public health
- Patient/client
    - Patient identifiers
        - Id
        - Name
        - Date of birth

- Patient address
- Responsible adult
- Funding program eligibility per immunization

- Eligibility status report

Public Health Tracking Vaccine Information Sheet (VIS) Activity

Story Board:

The VIS is a document that providers are required to share with persons being immunized. The document highlights why the immunization is important and lists potential side effects. Providers must record the date the VIS was shared with the patient, the target diseases that are covered and the version of the VIS document.

Suzy Patient (DOB 12/12/2009) is due for an MMR immunization. Her mother is shown the VIS document (Version date 1/1/2010). The nurse reviews the contents to assure that Mom understands the information. The Mom consents to allow Suzy to get immunized. The nurse records the date the VIS was shared, the document type identifier and the version date in the clinic's EHR-s. The EHR-s transmits the VIS information, along with the updated immunization record.

Two weeks later, Mom is concerned about a possible side effect from the immunization. The clinic determines which VIS sheet was given and the date. Mom is shown the VIS again.

Actors:

- Clinician
- Patient
- IIS
- EHR
- Parent

Actions/Interactions:

- Record VIS date
- Record consent
- Request patient record
- Review VIS date

Concepts:

- Vaccination event

    - Lot number
    - Vaccine type
    - Vaccination date
    - Vaccine information sheet
        - Version date
        - Delivery date
    - Clinician
        - Ordering
        - Administering
        - Public health
- Patient/client
    - Patient identifiers
        - Id
        - Name
        - Date of birth
    - Patient address
    - Responsible adult

NSW-Manage Immunization Register

Story board:

The manager of the NSW Immunization Register adds a new vaccine and attendant rules to the NSW IR. These rules and metadata will inform users of the IR on what vaccine to give and when.
A new Immunization Unit has been formed. The manager of the NSW IR creates a new organization in the register, entering:

- Organization type and Area Health Service
- Contact information (address, phone, etc.)
- Organization Name
- Managers name

- Contact person

An immunization team leader is informed by the school office that the principal and school hours have changed since their last immunization clinic held at the school. The record for the school is updated when the team returns to the Public Health Unit.

Actors:

- IIS manager
- Immunization team leader
- Immunization information system (Immunization registry)

Actions/Interactions:

- Manage CDS engine
- Manage entity data in IIS
    - Immunization unit
    - School data

Concepts:

- Organization type and Area Health Service
- Contact information (address, phone, etc.)
- Organization Name
- Managers name
- Contact person
- Vaccine type
- Validation rules
- Forecasting rules
- Immunization clinic
    - Date
    - location

NSW—Record Vaccination Events

Story Board 1:

100 students in year 7 at Sydney Girls High School were vaccinated with HPV dose 1 and Hepatitis B dose 1. The user enters data into the immunization registry from two bundles of consent forms, with one bundle consisting of 100 HPV consent forms and the other bundle consisting of 100 Hepatitis B consent forms. (Note: a bundle consists of all completed consent forms per vaccine per school per grade e.g. HPV, Mosman High School, Grade 7).

The User selects form from bundle and requests ”search for person on register” and enters first name, last name, date of birth. If the person is not found, User adds demographics and address. Otherwise User views returned matches which list first name, middle name, last name and date of birth and selects person record. User adds vaccination consent data. User adds person’s vaccination data

Actors:

- IIS user
- Students
- Immunization registry (IIS)

Actions/Interactions:

- Find person query
- Return person response
- Update demographics
- Record immunizations

Story Board 2:

Amy Theresa Scarfe has moved from Wollongong High School to Hornsby Girls High School, and has a twin sister whose name is Amy Angela Scarfe. Amy Theresa received HPV dose 1 at Wollongong and HPV dose 2 at Hornsby Girls High. Her form is in the bundle of HPV consent forms returned to the PHU after the second immunization clinic. The nurse who verified the consent by phone, marked up a new form with Amy Theresa’s demographics and consent details, parent/guardian address and school name and dose 2 data.

User requests “search for person on register” and enters first name, last name, date of birth for Amy Scarfe. Two patient records are returned, one for each twin. The user selects the one for Amy Theresa and updates demographics. If consent data has not been entered, then User adds consent data. The User adds person’s vaccination data, which includes name of new school.

Actors:

- IIS user
- Patient
- clinician

- Immunization registry (IIS)

Actions/Interactions:

- Find person query
- Return person response
- Select person
- Update demographics
- Record immunizations

Story Board 3:

Sue received HPV dose 1 at Sydney Girls High. Her form is in the bundle of 95 HPV consent forms returned after the second visit with a notification pro forma from the principal that consent was with drawn. The immunization nurse marked the consent form with a note that consent was withdrawn and dose 2 was not administered.

The User requests ”search for person on register” and enters first name, last name, date of birth. The User views returned matches which list first name, middle name, last name and date of birth and selects person record. The User enters the consent withdrawn date and consent status as withdrawn. The User adds vaccination status (not completed : withdrawn consent) to person’s HPV vaccination data corresponding to the dose that was missed.

Actors:

- IIS user
- Clinician
- Immunization registry (IIS)

Actions/Interactions:

- Find person query
- Return person response
- Select person
- Update demographics
- Update consent status

Concepts:

- Vaccination event
    - Lot number
    - Vaccine type

    - Vaccination date
    - Clinician
        - Ordering
        - Administering
        - Public health
    - Administered dose number
    - Vaccine series
        - status
- Patient/client
    - Patient identifiers
        - Id
        - Name
        - Date of birth
    - Patient address
    - Responsible adult
    - Registry status
    - Gender
    - Consent to administer
    - School
    - Grade in school

NSW—Generate Missed Dose Letter

Story Board:

An Immunization team has returned from a visit to Dubbo High School on August 28, 2009 where HPV dose 3 and Hepatitis B dose 2 was administered. The forms are bundled separately as 60 HPV consent forms and 120 Hepatitis B consent forms. Due to absence on the day of the clinic, fifteen girls missed their HPV dose 3 and twenty-five students missed their Hepatitis B dose 2. The consent form data is entered after the clinic (by vaccination) and the vaccination status for those who missed doses is flagged as “not completed-missed dose”. Missed dose letters are then generated for all students at Dubbo High

School who missed their scheduled dose on August 28 – 15 letters regarding girls' missed HPV missed dose 3 and missed Hepatitis B dose 2 and ten letters regarding boys' missed Hepatitis B dose 2.
User modifies the template to make the generated letter tailored for this specific event.

Actors:

- IIS User
- Clinician
- Immunization Information System

Actions/Interactions:

- Find patient records
- Record immunization records
- Record consent status
- Record up to date status
- Create report
    - Reminder of missed dose letter
- Modify report output

Concepts:

- Vaccination event
    - Lot number
    - Vaccine type
    - Vaccination date
    - Clinician
        - Ordering
        - Administering
        - Public health
    - Administered dose number
    - Vaccine series
        - status
- Patient/client
    - Patient identifiers
        - Id
        - Name
        - Date of birth

    - Patient address
    - Responsible adult
    - Registry status
    - Gender
    - Consent to administer
    - School
    - Grade in school
- Vaccine distributor
- Recall/reminder
- Missed dose

NSW—Generate vaccination history for a patient

Story Board:

An Immunization Coordinator has received a letter from a parent requesting a copy of their child's vaccination history. The parent has provided their email address, and the Co-coordinator updates the 'parent/guardian email" data field, and will email the vaccination history. User requests "search for person on register" and enters first name, last name, date of birth. User views returned matches (first name, middle name, last name and date of birth) and selects person record. User enters parent/guardian name, and adds their address if this is not already stored on the Register. User adds email address to parent/guardian information. User requests "display vaccination history template" selecting source from "register template folder" (see Appendix A4.1 for generic template) or from "my organization's template folder". User may tailor vaccination history template. If User has tailored letter, then User can requests "save template" in "my organization's template folder" . User requests mail merge on vaccination history. User may request "attach consent forms". User may select "print" for mailing, or select "email" to generate an email to parent/guardian's email address.

Actors:

- Immunization coordinator
- Parent
- IIS User
- Immunization Registry (IIS)

Actions/Interactions:

- Update parent information

- Find patient record
- Return patient record
- Update patient demographics
- Modify template
- Create report
    - Letter and vaccination record

Concepts:

- Vaccination event
    - Lot number
    - Vaccine type
    - Vaccination date
    - Clinician
        - Ordering
        - Administering
        - Public health
    - Administered dose number
    - Vaccine series
        - Status
- Vaccination history
- Patient/client
    - Patient identifiers
        - Id
        - Name
        - Date of birth
    - Patient address
    - Responsible adult

        - email
    - Registry status
    - Gender
    - Consent to administer
    - School
    - Grade in school
- Consent to vaccinate form

NSW—Manage an Immunization Clinic

Story Board:

An Immunization Co-coordinator plans to hold three immunization clinics at Duval High School during 2010. Clinic 1 is for Year 7 to receive HPV dose 1, and Hepatitis B dose 1, and for Year 10 to receive dTpa vaccine; Clinic 2 is for Year 7 to receive HPV dose 2 and Varicella; Clinic 3 is for Year 7 to receive HPV dose 3 and Hepatitis B dose 2. The Co-coordinator creates a record about a clinic location with suggested dates and may generate a letter to the school principal requesting confirmation of the suggested dates and school data.

An Immunization Co-coordinator plans to hold three immunization clinics at Duval High School during 2010. Confirmed dates for the clinic and up-to-date school data, including contact persons and projected enrollments, have been returned. The Co-coordinator will update school details (e.g. projected enrolment numbers) separately as per use case 3. The Co-coordinator updates the clinic records with confirmed dates for all doses to be administered at the school during the year. The Co-coordinator updates the clinic records with start and end time of clinic, and names of Nurse Immunizers who will be rostered on for each clinic.

An immunization team held an immunization clinic for Year 7 to receive HPV dose 2 and for Year 10 to receive dTpa vaccine. When the team returns to the PHU after the clinic, the immunization clinic record is updated with the following data for each vaccine administered at the clinic: vaccine batch number, dose number, grade, students vaccinated and wastage, and any notes.

Actors:

- Immunization coordinator
- School official
- IIS
- Immunizers

Actions/Interactions:

- Manage clinic schedule
- Create report
    - Letter notifying of clinic
- Record immunization history

Concepts:

- Vaccination event
    - Lot number
    - Vaccine type
    - Vaccination date
    - Clinician
        - Ordering
        - Administering
        - Public health
    - Administered dose number
    - Vaccine series
        - status
- Patient/client
    - Patient identifiers
        - Id
        - Name
        - Date of birth
    - Patient address
    - Responsible adult
    - Registry status
    - Gender
    - Consent to administer

    - School
    - Grade in school
- Vaccination clinic
    - Location
    - Staff
    - date

Utilizing and Accessing an Immunization Information System (Immunization Registry)

Note:

This storyboard highlights the types of interactions that can be expected in these types of transactions. It may be accomplished by a number of routes, depending on architecture.

Story Board:

Nurse Nightingale works at an immunization clinic. The following activities occur during the course of a typical day.

Nurse Nightingale receives an alert of a hepatitis B outbreak within her jurisdiction. She runs queries against the jurisdictional Client and Immunization Registries to identify individuals who are not fully immunized against hepatitis B. She begins by getting a list of eligible candidates from the Client Registry. The registry responds with a list of all eligible immunization candidates, who live within her jurisdiction. Next she gets a list of all of their immunization events from the Immunization Registry. By comparing the results, she is able to determine who has not yet received their hepatitis B vaccination. Nightingale administers an MMR vaccine to Kari Kidd and records the event on the jurisdiction's immunization registry.

Neville Nuclear has accepted a new job as a healthcare worker. His employer has asked for a copy of his hepatitis B vaccinations. Neville completed the entire 3 dose series six months ago at the public health travel clinic. Nightingale queries the Immunization Registry and is presented with the dates and details for each of the three hepatitis B doses. She then queries for greater detail against each of the listed immunization records. Nurse Nightingale prints an official vaccination report for Mr. Nuclear.

Actors:

- Clinician
- Patient
- Immunization registry (IIS)
- Client registry (Master Person Index)

Actions/Interactions:

- Patient Registry Get Demographics Query
- Patient Registry Get Demographics Query Response
- Immunization Candidate Query
- Immunization Candidate Query Response
- Record Immunization Request
- Record Immunization Request Accepted
- Immunization Candidate Query
- Immunization Candidate Query Response
- Immunization Query
- Immunization Query Response
- Generate report (immunization record)

Concepts:

- Vaccination event
    - Lot number
    - Vaccine type
    - Vaccination date
    - Clinician
        - Ordering
        - Administering
        - Public health
    - Administered dose number
    - Vaccine series
        - status
- Patient/client
    - Patient identifiers
        - Id

        - Name
        - Date of birth
    - Patient address
    - Responsible adult
    - Registry status
    - Gender
    - Consent to administer
    - School
    - Grade in school
- Vaccination history report

Retrieving a list of immunization records

Story Board:

Neville Nuclear is traveling overseas and has an appointment with his public health nurse to determine what vaccinations he requires. Nurse Nightingale confirms Neville's identity by querying the jurisdictional client registry.

She then queries the jurisdictional immunization registry for a list of all the vaccine administrations that Neville has received.

Actors:

- Patient
- Clinician
- Person registry (MPI)
- Immunization Registry (IIS)

Actions/Interactions:

- Immunization Candidate Query
- Immunization Candidate Query Response
- Patient Registry Get Demographics Query
- Patient Registry Get Demographics Query Response

Concepts:

- Vaccination event

    - Lot number
    - Vaccine type
    - Vaccination date
    - Clinician
        - Ordering
        - Administering
        - Public health
    - Administered dose number
    - Vaccine series
        - status
- Patient/client
    - Patient identifiers
        - Id
        - Name
        - Date of birth
    - Patient address
    - Gender
    - Consent to administer
    - School
    - Grade in school

Report Adverse Event Associated with a vaccination

Story Board 1:

Susan Q Public is the mother of Sam, a three year old. Sam received immunizations on 2/1/12 at his pediatrician's office. Two days later, he developed a fever of 102 F, became lethargic during the afternoon. At 5:00 PM, he experienced a grand mal seizure, his first ever. His mother called 911 and he was transported to the ED at the local hospital. The ED clinician checked his immunization history by querying the state IIS. She noted that he had been immunized 2 days previous. He had received HIB-PRP-OMP, MMRV and DTAP-Hep B-Polio immunizations. The clinician determined that an adverse event may have been associated with one of these immunizations. She completed a Vaccine Adverse Event Report and submitted it to the national AE registry via fax.

Story Board 2:

Susan Q Public decided to report her son's adverse events to the national AE registry. She went on line and found the telephone number for reporting an AE. A staff person at the AE registry interviewed Ms. Public and completed an AE report form on her behalf.

Story Board 3:

The electronic medical record system at the local hospital uses a Clinical Decision Support (CDS) application to facilitate the identification and reporting of AEs to the national AE registry. Information received via the Health Information Exchange suggests a probable AE based upon an ED encounter record for Sam Public. He was seen in the ED during the day because he experienced seizures and a fever following vaccinations identified in his immunization history record. The EHR system compiles the information on the patient and any associated vaccination information for the patient's siblings if applicable. All information is compiled into an AE report and sent to the AE registry. The AE registry receives the report, assesses it for completeness and acknowledges receipt. The EHR notifies the clinician that an AE report had been initiated and transmitted.

Actors:

- Clinician
- Patient
- Parent
- IIS
- EHR System
- AE registry
- CDS engine
- HIE

Actions/Interactions:

- Request patient records
- Receive immunization history
- Transmit AE report

Concepts:

- Vaccination event
    - Lot number
    - Vaccine type
    - Vaccination date

    - Vaccine expiration date
    - Vaccine dose or dose in series
    - Manufacturer
    -
- Patient/client
    - Patient identifiers
        - Id
        - Name
        - Date of birth or age at vaccination?
- Evaluated history (patient and siblings, if applicable)
- AE symptoms and onset date
- AE outcome or current patient status (if known)
- Forecast
- ACIP schedule
- Historical immunization record

PHER Immunization DAM Use Case Actors

Actors are the roles played by entities that have a stake in the successful operation of a use case or set of use cases. This document organizes actors in two ways. First there are entity-based actors. These represent things in the real world. Second there are role-based actors. Many entity actors play multiple roles. It is often simpler to refer use cases and activities to roles based actors, with the understanding that various entities may play these roles.

Entity based actors

This package contains actors that reflect real-world entities.

A01: Immunization Information System

According to the CDC IISSB: Immunization Information Systems are confidential, population-based, computerized information systems that attempt to collect vaccination data about all persons within a geographic area.

A02: Patient

A patient is a person receiving health care. In our models, this is generally related to immunization.

A03: Patient Registry

A patient registry is an information system with the goal of maintaining demographic information about a patient. Included in this function is tracking identifiers from different sources.

A04: Provider

A provider is a person providing health care, that is a clinician.

A05: Regulator

A regulator is a person or agency which promulgates regulations.

A06: Research Subject

A research subject is a person who participates in research study as a target of the study.

A07: Researcher

A researcher conducts research studies.

A08: Manufacturer

A manufacturer makes products, vaccines in our case.

A09: Public Health

Public Health (also known as population health) fulfills a number of roles related to immunization. It is concerned about promoting the health of the population.

A10: Distributor

This actor distributes vaccine from manufacturer to end users.

A11: Provider Organization

A provider organization is an entity that providers belong to.

A12: Electronic Health Record System

An electronic health record system is an information system which contains patient's medical records.

A13: Health Information Exchange

This actor acts as a hub to facilitate access to consolidated health records from multiple sources.

A15: Vital Records system

The vital records system tracks birth and death events. They may also collect information on birth doses of Hepatitis B.

A16: Relabeler

A relabeler repackages vaccines and sells them under their label.

A17: PHR system

This is the Personal Health Record system. It houses a health record owned and maintained by the person it is about.

A18: Government Payer

Vaccine is often paid for with public funds. This actor is involved in both paying and assurance of correct usage of vaccines.

A19: Adverse Event Registry

This actor represents the system intended to capture and track adverse events. It is typically a national effort.

A20: Designated SME group

This is the group of clinical SME responsible for rule development. An example in the US would be the ACIP.

A21: CDS support SME

This is a SME who integrates series rules into CDS engine.

A22: Responsible Person

A responsible person is the parent or guardian of a patient receiving immunizations. This person makes medical decisions for the patient who is not old enough to make these decisions on his/her own.

PHER Role-based Actors

This package contains role-based actors. Different entity based actors can plan the same role. Some entities play many roles. For instance, an IIS may be an immunization history consumer when immunization histories are being recorded into it. It can later be an immunization history supplier when another system requests an immunization history.

AR01: Immunization History Supplier

This actor supplies immunization histories to other systems, particularly Immunization History consolidators.
Some of the immunization history suppliers include:

- Electronic Health Record systems
- Personal Health Record systems
- Immunization Information Systems
- Vital Records systems
- Billing systems

AR02: Immunization history consolidator

The goal of this actor is to be a source for complete, consolidated immunization histories for individuals. These systems may maintain a centralized repository or may keep track of where primary data are and pull them together when needed. Some examples of immunization history consolidators include:

- Immunization information system (IIS)
- Health Information Exchange (HIE)

AR03: Immunization history consumer

This actor is interested in using / getting consolidated immunization history for individuals. Actors who may play this role include:

- EHR
- PHR
- IIS
- Patient
- Provider
- Public Health
- Schools
- Daycare
- Camps
- Payer
- Employer
- Evaluation and forecasting provider
- Adverse Event registry

AR04: Immunization Report consumer

This actor requests and uses immunization reports. Actors who may play this role include:

- EHR
- PHR
- Patient
- Provider
- Public Health
- Government Payer
- Non-governmental Payer
- Government agency
- Adverse Event registry

AR05: Immunization Report creator

This actor supplies immunization reports. It requires participation of an Immunization History Consolidator in most cases. Actors who may play this role include:

- IIS

- HIE
- EHR
- Public Health

AR06: Evaluation/forecast provider

This actor evaluates a patient's immunization history and other factors and produces a forecast of next doses due. It also returns the evaluation of the history. Actors who may play this role include:

- IIS
- CDS service
- EHR

AR07: Evaluation/forecast consumer

This actor may represent any system, which requests and receives CDS services. Actors who may play this role include:

- EHR
- PHR
- HIE
- IIS
- School
- Day care
- Payer

AR08: Inventory Management supplier

This actor tracks vaccine inventory. It tracks orders, shipments, transfers, wastage, usage. Some systems, which may play this role, include:

- IIS
- EHR
- Distributor

AR09: Inventory Management Consumer

This actor uses the output of an Inventory Management Supplier. Actors who may play this role include:

- Government payer
- Distributor
- EHR
- Provider organization

- Public health
- Manufacturer
- Adverse Event Registry

AR10: Identifier Consumer

The goal of this actor is to use the services of an identifier provider. Among the entities that are likely to fulfill this role are:

- EHR
- IIS
- PHR
- Public health information systems
- Health information exchange
- Adverse event registry

AR11: Identifier supplier

The goal of this actor is to be a register of identifiers. Entities that may play this role include:

- Master patient index
- IIS
- HIE

AR12: Demographic consumer

This actor consumes demographic information from demographic suppliers. Entities that may play this role include:

- IIS
- EHR
- PHR
- PH system
- Adverse Event registry

AR13: Demographic supplier

The goal of this actor is to supply demographic information to other actors. Entities that may play this role include:

- IIS
- EHR
- PHR
- Vital Records System

AR14: format transformer

This actor transforms a message or document into another format. For example, the transformer may take a Version 2 message and convert it to a Version 3 message or document.

Data Information Model Documentation

PHER Immunization DAM Information View Package

Notes: The Immunization Domain Information View contains diagrams and supporting text which document the entities and data needed to support information systems which include immunizations.

Immunization History Package

Notes: This package contains information related to a persons immunization records.

Immunization History Diagram

The immunization history is collected clinical and demographic data related to a person's immunizations.

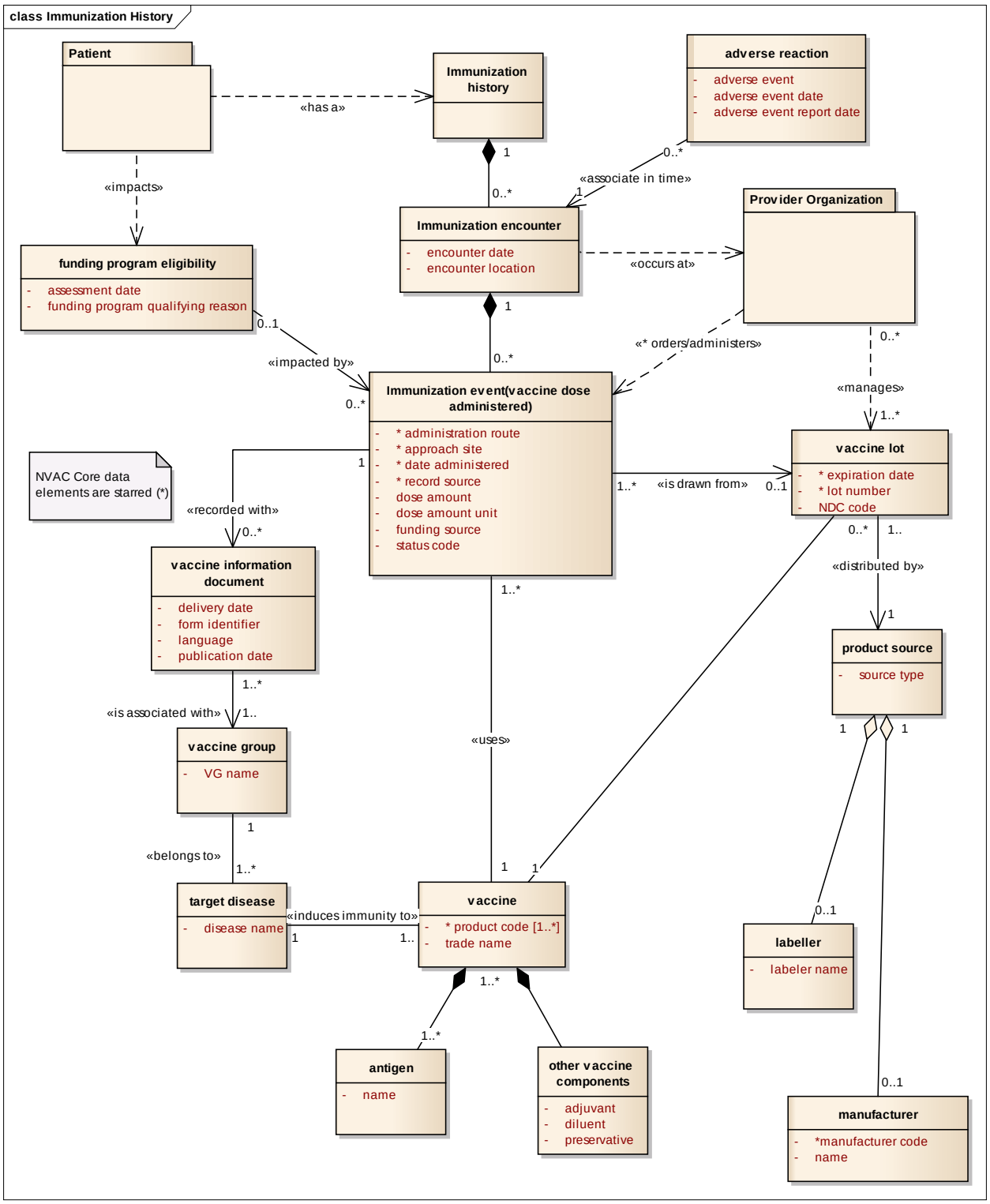

Figure: 1- *Immunization History*

Immunization history (Class)

Notes: The Immunization history is the collection of data about a patient's immunizations. It includes demographic data and immunization event data.

Funding program eligibility (Class)

Notes: The funding program eligibility captures what governmental program the person qualifies for that pays for vaccination. In the US the national program is the Vaccines for Children (VFC) program. In addition, there are state and local funding programs. This class does not specify who actually paid for a vaccination. That may be captured in funding source. In the US, the eligibility category relates to both patient specific characteristics (such as Medicaid) and vaccine type. (That is, does the type of vaccine used in this vaccination qualify for VFC?)

Attributes

Name	Multiplicity	Notes
assessment date	1: 1	The date the eligibility was assessed.
funding program qualifying reason	1: 1	The categorical reason that the person qualifies for the funding program.

Relationships

Connector	Association	Type
«impacts»	Patient. funding program eligibility.	Dependency
«impacted by»	**0..1** funding program eligibility. **0..*** Immunization event(vaccine dose administered).	Association

labeler (Class)

Notes: A labeler repackages vaccine for sale. In some cases a manufacturer is also the labeler.

Attributes

Name	Multiplicity	Notes
labeler name	1: 1	The name of the company that repackages and labels a vaccine product.

Relationships

Connector	Association	Type
	0..1 labeller. **1** product source.	Aggregation

manufacturer (Class)

Notes: This is the company that produces the vaccine.

Attributes

Name	Multiplicity	Notes
manufacturer code	1: 1	Code representing the manufacturer.
name	1: 1	The name of the manufacturer

target disease (Class)

Notes: The target disease is the disease that a vaccine is intended to prevent.

Attributes

Name	Multiplicity	Notes

disease name	1: 1	The disease which is intended to be prevented by the vaccine.

vaccine lot (Class)

Notes: A vaccine lot is a packaged batch of vaccine.

Attributes

Name	Multiplicity	Notes
lot number	1: 1	The lot number is an identifier of the vaccine lot.
expiration date	1: 1	The expiration date is the date that the vaccine lot is considered too old to use effectively.
NDC (National Drug Code)	1:1	This is the US Food and Drug Administration (FDA) product code.

adverse reaction (Class)

Notes: This is an adverse medical condition that is related in time to an immunization encounter and attendant immunization events.

Attributes

Name	Multiplicity	Notes
adverse event	1: 1	This is an adverse health condition.
adverse event date	1: 1	This is the date that the adverse event began.
adverse event report date	1: 1	The date the adverse event was reported.

vaccine information document (Class)

Notes: A vaccine information document is an educational document intended to outline the risks and benefits of the vaccine. It outlines the impact of infection by the disease causing organism. A vaccine information sheet (VIS) is a US realm document example.

Attributes

Name	Multiplicity	Notes
publication date	1: 1	Date Vaccine information sheet was published. In effect, version of VIS.
language	1: 1	The language is the language the document is written in.
form identifier	1: 1	The form identifier indicates which vaccine information document is shared.
delivery date	1: 1	The delivery date is the date that the specific vaccine information document is shared with the patient or patient's responsible person.

antigen (Class)

Notes: An antigen is the moiety which triggers an immune response in a recipient.

Attributes

Name	Multiplicity	Notes
name	1: 1	The name of the antigen.

Immunization encounter (Class)

Notes: The immunization encounter is the event when patient is seen by the clinician for the purposes of

vaccination.

Attributes

Name	Multiplicity	Notes
encounter date	1: 1	The date when the patient received medical care related to immunization.
encounter location	1: 1	The location of the medical encounter.

Immunization event(vaccine dose administered) (Class)

Notes: An immunization event records the receipt of one dose of vaccine.

Attributes

Name	Multiplicity	Notes
* administration route	1: 1	The route of vaccine administration
* approach site	1: 1	The body site where vaccine was administered.
* date administered	1: 1	The date vaccine was administered
* record source	1: 1	This field indicates if the record is from a historical source or was administered by the provider.
dose amount	1: 1	The quantity of vaccine administered
dose amount unit	1: 1	The unit of dose amount (e.g. ml)
funding source	1: 1	This indicates who actually paid for the immunization.
status code	1: 1	This may indicate that dose was considered compromised.

other vaccine components (Class)

Notes: includes diluent, preservative, adjuvant

Attributes

Name	Multiplicity	Notes
adjuvant	1: 1	This is an additive intended to improve the effectiveness of the vaccine.
diluent	1: 1	A diluent is the solution that is used to reconstitute vaccines.
preservative	1: 1	A preservative is a compound added to vaccines to prevent spoilage.

Relationships

Connector	Association	Type
	other vaccine components. vaccine.	Aggregation

vaccine (Class)

Notes: A vaccine is a product that is intended to induce immunity when administered.

Attributes

Name	Multiplicity	Notes
* product code	1: *	code indicating the vaccine administered. must accommodate the recording of historical vaccines with unspecified

		formulations.
trade name	1: 1	product name of the vaccine administered. can be derived from post-coordination of vaccine product code and manufacturer.

Relationships

Connector	Association	Type
	1..* antigen. **1..*** vaccine.	Aggregation
	other vaccine components. vaccine.	Aggregation
«induces immunity to»	**1..** vaccine. **1** target disease.	Association
«uses»	**1..*** Immunization event(vaccine dose administered). **1** vaccine.	Association
	1 vaccine. **0..*** vaccine lot.	Association

vaccine group (Class)

Notes: Vaccine group is a conceptual grouping of vaccines which reflects the way clinicians organize the goals for a person's immunizations. In most cases they reflect the goals to prevent a single disease. In a few cases for some of the early combination vaccines, they reflect the goals for several diseases. (e.g. MMR, DTaP)

Attributes

Name	Multiplicity	Notes
VG name	1: 1	The class of vaccines associated with one or more vaccine preventable diseases that are the target of published rules for vaccination (ACIP, for instance). There are some vaccine groups which include more than one disease (MMR).

vaccine lot (Class)

Notes: A vaccine lot is a batch of vaccine. This class represents all units of a vaccine lot controlled by a clinic. It is a subset of all vaccine associated with a vaccine lot.

Attributes

Name	Multiplicity	Notes
* expiration date	1: 1	The date when vaccine should no longer be used.
* lot number	1: 1	The lot number assigned by the manufacturer or relabeller
NDC code	1: 1	US specific code which includes: ◀ product ◀ labeler/manufacturer ◀ packaging

Relationships

Connector	Association	Type
«is drawn from»	**1..*** Immunization event(vaccine dose administered).	Association

Connector	Association	Type
	0..1 vaccine lot.	
«distributed by»	**1..** vaccine lot. **1** product source.	Association
	1 vaccine. **0..*** vaccine lot.	Association
«manages»	**0..*** Provider Organization. **1..*** vaccine lot.	Dependency
	1 vaccine lot. **1..*** package.	Association
«supplies vaccine for»	**0..*** vaccine lot. **0..*** Immunization event(vaccine dose administered).	Association
«maintained at»	**0..*** vaccine lot. **0..*** provider clinic site.	Association

Patient Package

Notes: The patient is the central character who has an immunization history and receives immunization.This package includes information specific to the patient including demographics and responsible persons.

Patient Diagram

This model documents the important data that support clinical care and public health around immunization.

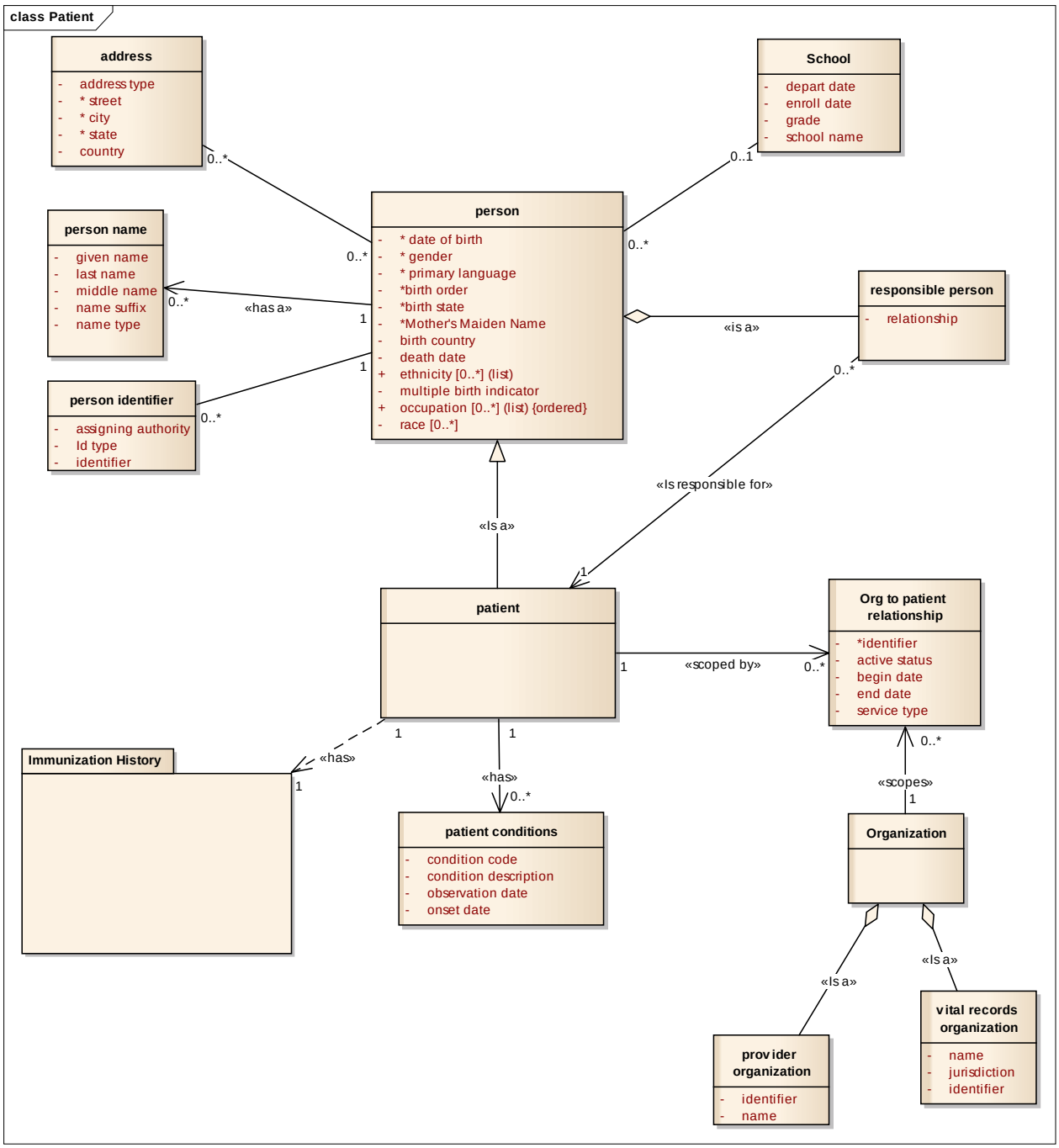

Figure: 2- *Patient*

address (Class)

Notes: Address is a postal location specification.

Attributes

Name	Multiplicity	Notes
address type	1: 1	Classification of address. for example home address or business address.

* street	1: 1	Street address. NVAC core data element for patient
* city	1: 1	NVAC core data element for patient
* state	1: 1	NVAC core data element for patient
country	1: 1	

Relationships

Connector	Association	Type
	0..* person. **0..*** address.	Association

Organization (Class)

Notes: This class represents any organization which has relationships to a person.

Org to patient relationship (Class)

Notes:

Attributes

Name	Multiplicity	Notes
*identifier	1: 1	includes MR #, *birth registration number
active status	1: 1	Indicates if the relationship between the patient and the organization is active.
begin date	1: 1	
end date	1: 1	
service type	1: 1	The nature of service provided from provider to patient.

patient (Class)

Notes: The patient is the person receiving care from a provider.

Relationships

Connector	Association	Type
«Is a»	patient. person.	Generalization
«Is responsible for»	**0..*** responsible person. **1** patient.	Association
«has»	**1** patient. **0..*** patient conditions.	Association
«scoped by»	**1** patient. **0..*** Org to patient relationship.	Association
«has»	**1** patient. **1** Immunization History.	Dependency
«has a»	patient. Immunization history.	Association
	patient. Person.	Dependency

patient conditions (Class)

Notes: Patient conditions are observations about the patient which impact forecasting next doses. These include allergies, previous adverse reactions and special risk factors.

Attributes

Name	Multiplicity	Notes
condition code	1: 1	The code which identifies the condition that was observed.
condition description	1: 1	Text describing the condition/observation
observation date	1: 1	The date the condition was noted.
onset date	1: 1	The date the condition began

person (Class)

Notes: A person may play a number of roles, including patient, responsible person and clinician. This class contains primarily demographic information.

Attributes

Name	Multiplicity	Notes
* date of birth	1: 1	NVAC core data element for patient
* gender	1: 1	NVAC core data element for patient
* primary language	1: 1	NVAC core data element for patient
*birth order	1: 1	
*birth state	1: 1	
*Mother's Maiden Name	1: 1	
birth country	1: 1	
death date	1: 1	
ethnicity	0: *	The self-reported ethnicity
multiple birth indicator	1: 1	
occupation	0: *	
race	0: *	

Relationships

Connector	Association		Type
«has a»	**0..***	person.	Association
	0..*	telecommunications.	
«Is a»		patient.	Generalization
		person.	
«has a»	**1**	person.	Association
	0..*	address.	
	0..*	person.	Association
	0..1	School.	
«has a»	**1**	person.	Association
	0..*	person identifier.	
«has a»	**1**	person.	Association
	0..*	person name.	
«reports a»	**1**	person.	Association
	0..*	Race.	
«reports a»	**1**	person.	Association
	0..*	ethnicity.	
«has a»	**0..***	person.	Association
	0..*	occupation.	
		responsible person.	Aggregation

Connector	Association		Type
«is a»		person.	
	0..*	person.	Association
	0..*	address.	
	1	person.	Association
	0..*	person identifier.	

person identifier (Class)

Notes:

Attributes

Name	Multiplicity	Notes
assigning authority	1: 1	This is the authority responsible for creating this identifier. (the identifier owner)
Id type	1: 1	classifies the identifier. For example medical record number, birth registration number
identifier	1: 1	This uniquely identifies the person in the context of the assigning authority.

Relationships

Connector	Association		Type
	1	person.	Association
	0..*	person identifier.	

person name (Class)

Notes:

Attributes

Name	Multiplicity	Notes
name type	1: 1	
last name	1: 1	
middle name	1: 1	
given name	1: 1	
name suffix	1: 1	

provider organization (Class)

Notes:

Attributes

Name	Multiplicity	Notes
identifier	1: 1	
name	1: 1	

Relationships

Connector	Association		Type
«Is a»		provider organization. Organization.	Aggregation

responsible person (Class)

Notes: This is the parent or guardian of the person who is the patient.

Attributes

Name	Multiplicity	Notes
relationship	1: 1	

School (Class)

Notes: A school is an organization that some persons are associated with as students or teachers.

Attributes

Name	Multiplicity	Notes
depart date	1: 1	The date the student was no longer associated with the school.
enroll date	1: 1	The date the student enrolled in the state.
grade	1: 1	The grade in school of the person
school name	1: 1	The name of the school

Relationships

Connector	Association	Type
	0..* person. **0..1** School.	Association

telecommunications (Class)

Notes:

Attributes

Name	Multiplicity	Notes
telecommunication type	1: 1	
* phone number	1: 1	NVAC core data element for patient
email	1: 1	

vital records organization (Class)

Notes: This class represents VR organizations.

Attributes

Name	Multiplicity	Notes
name	1: 1	
jurisdiction	1: 1	
identifier	1: 1	

Relationships

Connector	Association	Type
«Is a»	vital records organization. Organization.	Aggregation

Provider Organization Package

Notes: This package contains information related to an organization with a relationship to a person.

Provider Organization Diagram

The provider organization is the entity that represents affiliated providers.

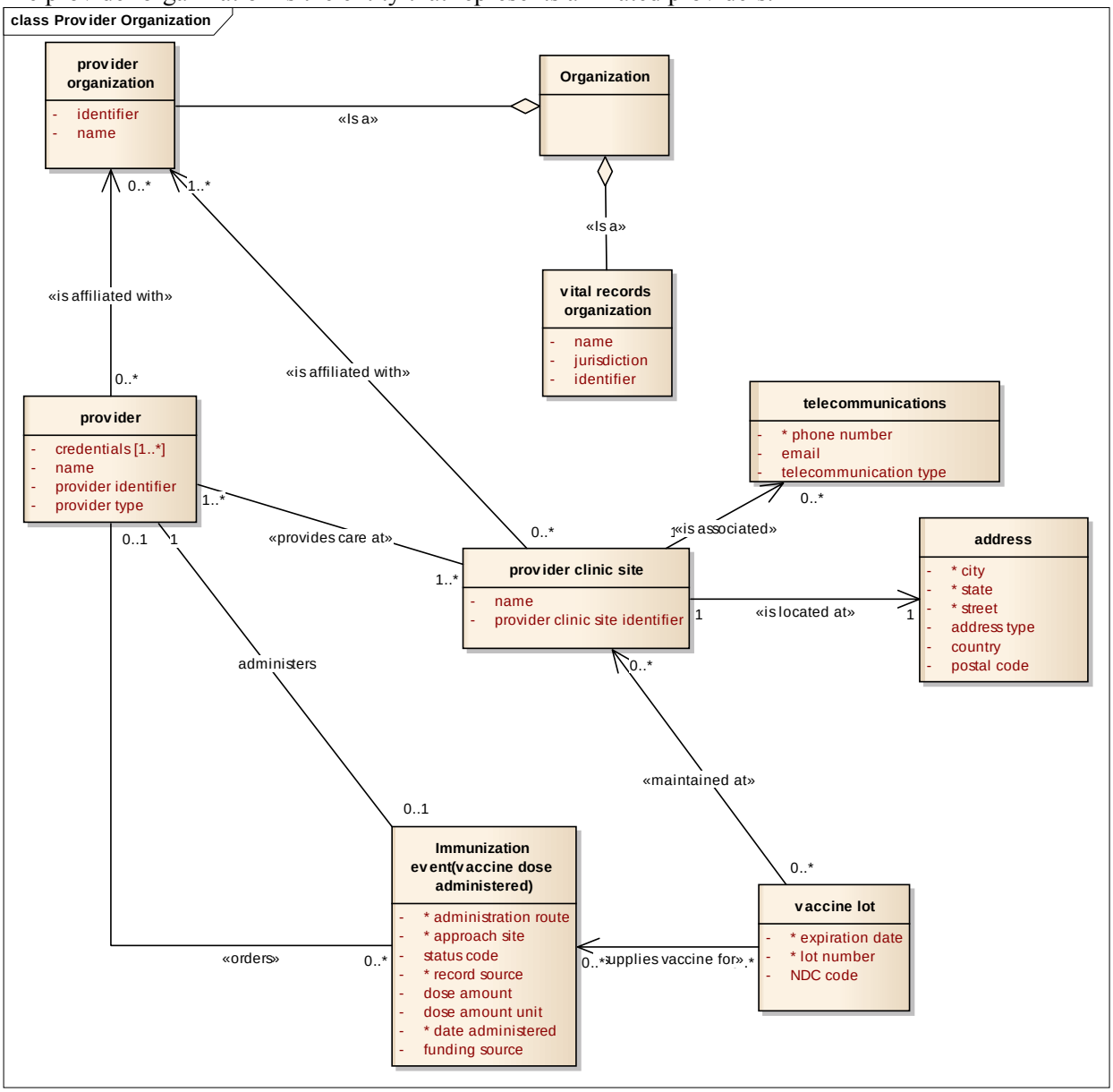

Figure: 3- *Provider Organization*

address (Class)

Notes:

Attributes

Name	Multiplicity	Notes
address type	1: 1	
street	1: 1	
city	1: 1	
state	1: 1	
country	1: 1	

Immunization event(vaccine dose administered) (Class)

Notes: An immunization event records the receipt of one dose of vaccine.

Attributes

Name	Multiplicity	Notes
* administration route	1: 1	route of vaccine administration
* approach site	1: 1	body site where vaccine was administered.
status code	1: 1	This may indicate that dose was considered compromised.
* record source	1: 1	This field indicates if the record is from a historical source or was administered by the provider.
dose amount	1: 1	quantity of vaccine administered
dose amount unit	1: 1	unit of dose amount (e.g. ml)
* date administered	1: 1	date vaccine was administered
funding source	1: 1	This indicates who actually paid for the immunization.

Relationships

Connector	Association	Type
«orders»	**0..1** provider. **0..*** Immunization event(vaccine dose administered).	Association
«supplies vaccine for»	**0..*** vaccine lot. **0..*** Immunization event(vaccine dose administered).	Association
	1 provider. **0..1** Immunization event(vaccine dose administered).	Association

provider (Class)

Notes:

Attributes

Name	Multiplicity	Notes
credentials	1: *	provider licensing credentials
name	1: 1	Name of provider
provider identifier	1: 1	Unique provider identifier
provider type	1: 1	professional type of provider

provider clinic site (Class)

Notes:

Attributes

Name	Multiplicity	Notes
name	1: 1	Name of clinic site
provider clinic site identifier	1: 1	Unique identifier of the clinic site

provider organization (Class)

Notes: The provider organization is entity which represents one or more providers. It could be a large clinic system or a stand-alone provider.

Attributes

Name	Multiplicity	Notes
identifier	1: 1	Unique identifier for the provider organization.
name	1: 1	Unique text representation of the provider organization

telecommunications (Class)

Notes:

Attributes

Name	Multiplicity	Notes
telecommunication type	1: 1	
phone number	1: 1	
email	1: 1	

Schedule to immunization Package

Notes: This model shows the relationships between vaccines administered and the series defined in a schedule. The goal of the series is a to define a pathway to presumed immunity.

schedule to immunization Diagram

This model shows the relationship of vaccine doses administered and the rules used to validate and forecast.

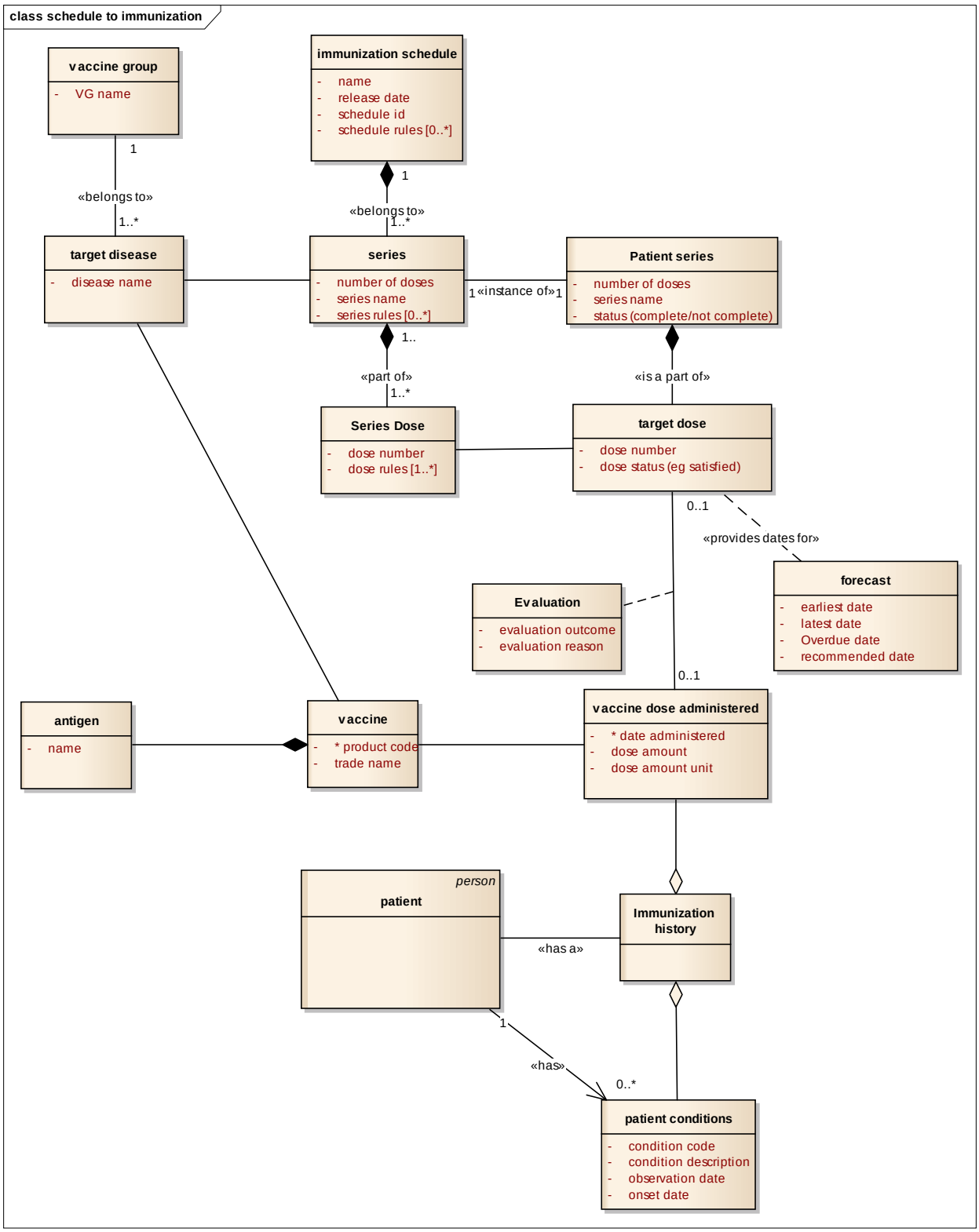

Figure: 4- *schedule to immunization*

antigen (Class)

Notes: An antigen is the moiety which triggers an immune response in a recipient.

Attributes

Name	Multiplicity	Notes
name	1: 1	

Relationships

Connector	Association	Type
	1..* antigen. **1..*** vaccine.	Aggregation

adverse reaction (Class)

Notes: this is an adverse medical condition that is related in time to an immunization encounter and attendant immunization events.

Attributes

Name	Multiplicity	Notes
adverse event	1: 1	
adverse event date	1: 1	

Evaluation (AssociationClass)

Notes: This represents the outcome of evaluation for the associated vaccine dose administered.

Attributes

Name	Multiplicity	Notes
evaluation outcome	1: 1	Indicates the outcome of the evaluation of this vaccine dose administered.
evaluation reason	1: 1	Indicates any circumstances which impacted the validation of this vaccine dose administered.

forecast (Class)

Notes: A forecast is a recommendation of when the target dose is due. This forecast is based on application of the rules of the series dose.

Attributes

Name	Multiplicity	Notes
earliest date	1: 1	date that is the earliest recommended date. this is not always the earliest date that a dose administered will be acceptable.
recommended date	1: 1	standard recommendation date
Overdue date	1: 1	Date when patient is considered behind schedule.
latest date	1: 1	latest date patient should receive the vaccine

Immunization history (Class)

Notes: An immunization history is the record of a person's immunizations and the attendant information.

immunization schedule (Class)

Notes: The immunization schedule is the published rules for evaluating vaccines administered and for forecasting next doses due.

Attributes

Name	Multiplicity	Notes
schedule id	1: 1	
name	1: 1	
release date	1: 1	

patient (Class)

Notes: the patient is the person receiving care from a provider.

Attributes

Name	Multiplicity	Notes
*birth order	1: 1	
multiple birth indicator	1: 1	
*birth state	1: 1	
birth country	1: 1	
* Mother's maiden last name	1: 1	NVAC core data element

patient conditions (Class)

Notes: Patient conditions are observations about the patient which impact forecasting next doses. These include allergies, previous adverse reactions and special risk factors.

Attributes

Name	Multiplicity	Notes
condition code	1: 1	The code which identifies the condition that was observed.
condition description	1: 1	Text describing the condition/observation
observation date	1: 1	The date the condition was noted.
onset date	1: 1	The date the condition began

Relationships

Connector	Association		Type
«has»	**1** **0..***	patient. patient conditions.	Association
		patient conditions. Immunization history.	Aggregation

Patient series (Class)

Notes: Patient Series is an instantiation in time of the Series that represents one path towards the goal of protection against a disease. It consists of a number of Target Doses.

Attributes

Name	Multiplicity	Notes
series name	1: 1	
number of doses	1: 1	
status (complete/not	1: 1	

complete)		

series (Class)

Notes: A series is one path to meet the goals for assuming protection against a target disease.

Attributes

Name	Multiplicity	Notes
name	1: 1	
number of doses	1: 1	
series rules	1: 1	see schedule domain model

Relationships

Connector	Association	Type
	series. target disease.	Association

Series Dose (Class)

Notes: A series dose is specification of how to determine if a particular dose administered meets the goals for that dose in the series.

Attributes

Name	Multiplicity	Notes
dose number	1: 1	

target disease (Class)

Notes: The target disease is the disease that a vaccine is intended to prevent.

Attributes

Name	Multiplicity	Notes
disease name	1: 1	The disease which is intended to be prevented by the vaccine.

Relationships

Connector	Association	Type
	series. target disease.	Association

target dose (Class)

Notes: Each target dose is one step in a patient series.

Attributes

Name	Multiplicity	Notes
dose number	1: 1	
dose status (eg satisfied)	1: 1	

vaccine (Class)

Notes: A vaccine is a product that is intended to induce immunity when administered.

Attributes

Name	Multiplicity	Notes

* product code	1: 1	code indicating the vaccine administered. must accommodate the recording of historical vaccines with unspecified formulations.
trade name	1: 1	product name of the vaccine administered. can be derived from post-coordination of vaccine product code and manufacturer.

Relationships

Connector	Association	Type
	1..* antigen. **1..*** vaccine.	Aggregation
	target disease. vaccine.	Association
	vaccine. vaccine dose administered.	Association
	antigen. vaccine.	Aggregation

vaccine dose administered (Class)

Notes: The vaccine dose administered is record of the actual immunization event.

Attributes

Name	Multiplicity	Notes
dose amount	1: 1	quantity of vaccine administered

vaccine group (Class)

Notes: Vaccine group is a conceptual grouping of vaccines which reflects the way clinicians organize the goals for a person's immunizations. In most cases they reflect the goals to prevent a single disease. In a few cases for some of the early combination vaccines, they reflect the goals for several diseases. (e.g. MMR, DTaP)

Attributes

Name	Multiplicity	Notes
VG name	1: 1	The class of vaccines associated with one or more vaccine preventable diseases that are the target of published rules for vaccination (ACIP, for instance). There are some vaccine groups which include more than one disease (MMR).

Dynamic Model:

The dynamic model captures the tasks and behaviors around immunization. The use case models show how the needs of various actors are met. The Activity diagrams show the high level work flow and system behavior. There are numerous architectures deployed today. These models seek to be neutral to these differences. The point to take away is that regardless of architecture, there are important use cases which need to be considered and accommodated in any of these architectures.

Package: PHER Immunization DAM Use Case

Notes: This package contains the Use Cases developed for Release 11 of the PHER Immunization Domain Analysis Model.

Use Case System View (Use Case Diagram)

This diagram illustrates the relationships between major systems and activities. Each package contains diagrams, which include the actors and use cases required to support the goals of the parent package. Note that the major actors are those with primary association with the packages and use cases in this diagram. Other actors not shown in this diagram will be found in the sub-diagrams.

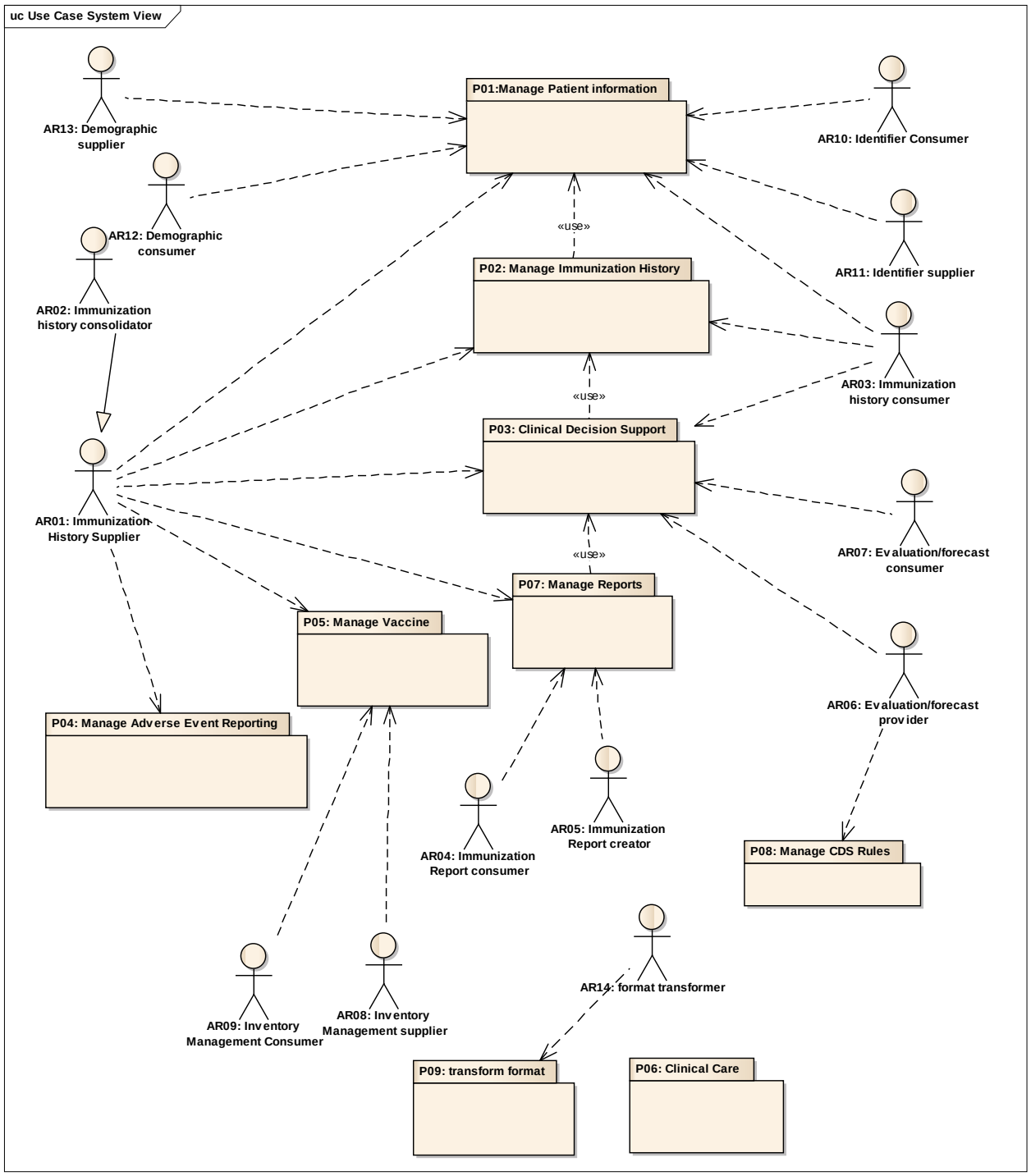

Figure: 1--Use Case System View

Package: P01:Manage Patient information

Notes: This package contains use cases related to managing patient identify and demographics.

Parent: PHER Immunization DAM Use Case

UC01: Manage Patient Information (Use Case Diagram)

This diagram shows the use cases and actors participating in Patient demographic data and identity management.

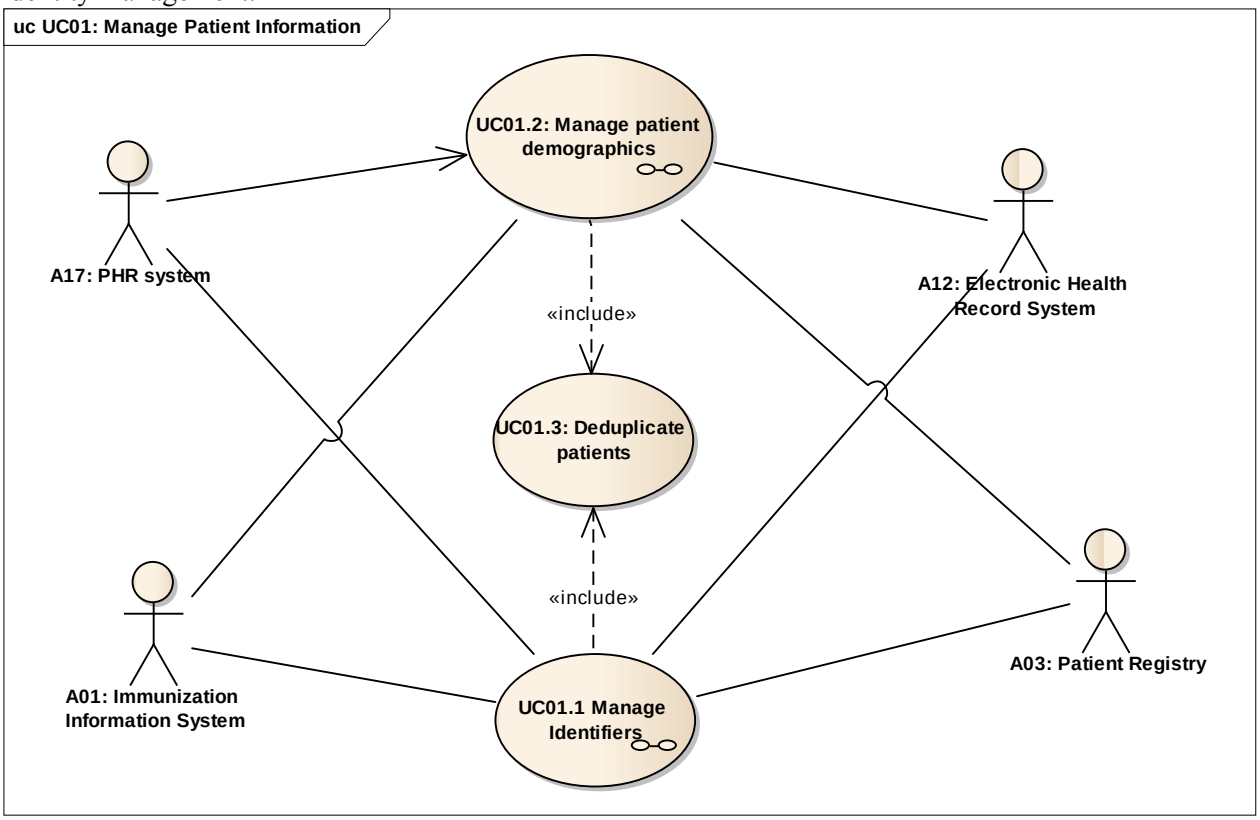

Figure: 2--UC01: Manage Patient Information

UC01.2: Manage Patient Demographics (Use Case Diagram)

This diagram shows the actors and tasks associated with recording patient demographics.

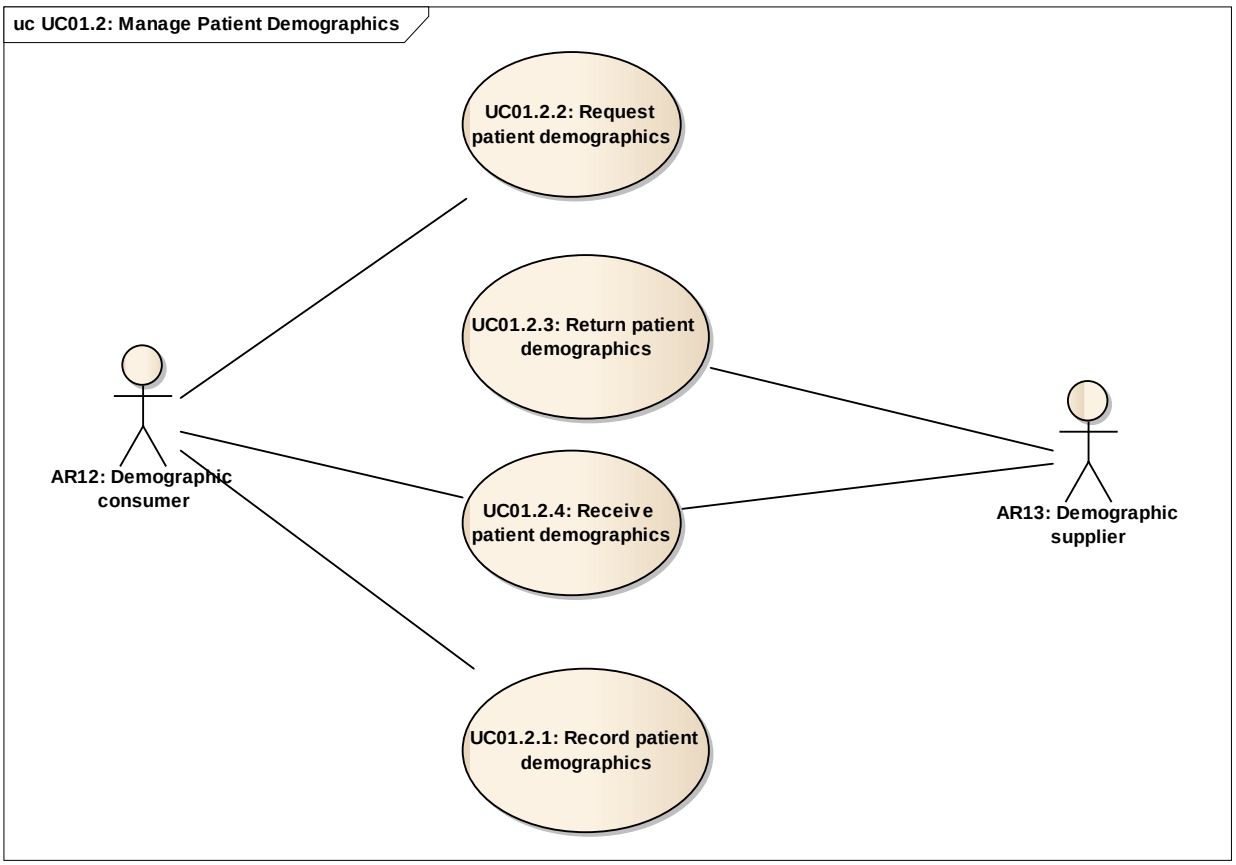

Figure: 3--UC01.2: Manage Patient Demographics

UC01.1.1 Manage Identifiers (Use Case Diagram)

The goal of this use case is to support recording and management of personal identifiers.

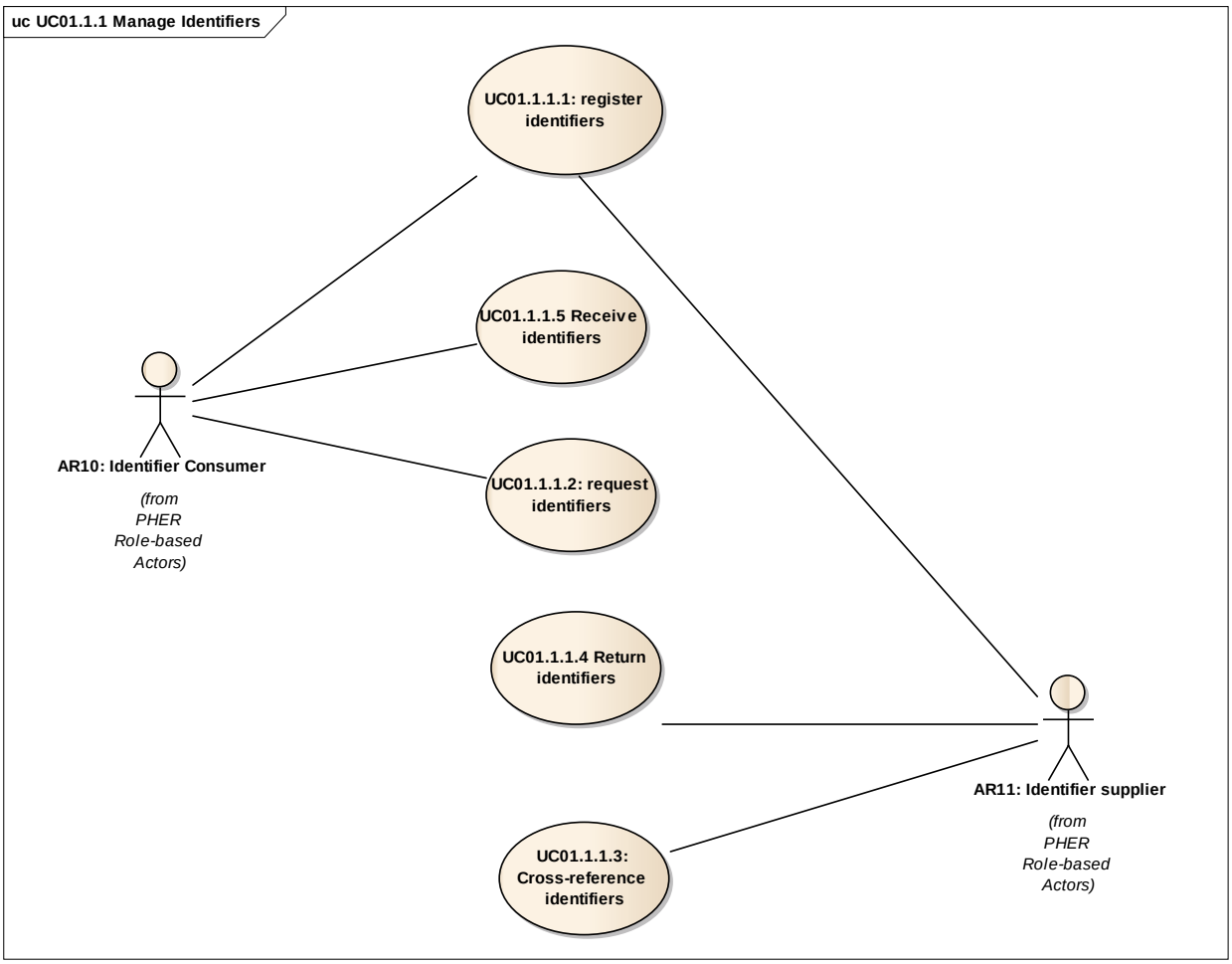

Figure: 4--UC01.1.1 Manage Identifiers

Element Type	Name	Notes
Actor	A01: Immunization Information System	According to the CDC IISSB: Immunization Information Systems are confidential, population-based, computerized information systems that attempt to collect vaccination data about all persons within a geographic area.
Actor	A03: Patient Registry	A patient registry is an information system with the goal of maintaining demographic information about a patient. Included in this function is tracking identifiers from different sources.
Actor	A12: Electronic Health Record System	An electronic health record system is an information system which contains patient's medical records.
Actor	A17: PHR system	This is the Personal Health Record system. It houses a health record owned and maintained by the person it is about.
Actor	AR10: Identifier Consumer	The goal of this actor is to use the

		services of an identifier provider. Among the entities that are likely to fulfill this role are: • EHR • IIS • PHR • Public health information systems • Health information exchange • Adverse event registry
Actor	AR11: Identifier supplier	The goal of this actor is to be a register of identifiers. Entities that may play this role include: • Master patient index • IIS • HIE
Actor	AR12: Demographic consumer	This actor consumes demographic information from demographic suppliers. Entities that may play this role include: • IIS • EHR • PHR • PH system • Adverse Event registry
Actor	AR13: Demographic supplier	The goal of this actor is to supply demographic information to other actors. Entities that may play this role include: • IIS • EHR • PHR • Vital Records System
Use Case	UC01.1 Manage Identifiers	The goal of this use case is to manage identifiers of patients.
Use Case	UC01.1.1.1: register identifiers	The goal of this use case is to register patient identifiers with an identity

		resolution system/service.
Use Case	UC01.1.1.2: request identifiers	The goal of this use case is to get identifiers for a patient based on specified parameters. The parameters may be demographic or may rely on cross-referencing identifiers.
Use Case	UC01.1.1.3: Cross-reference identifiers	The goal of this use case is to maintain a cross reference of patient identifiers.
Use Case	UC01.1.1.4 Return identifiers	The goal of this use case is to return patient identifiers in response to a request for identifiers.
Use Case	UC01.1.1.5 Receive identifiers	The goal of this use case is to receive identifiers from id source in response to a request for identifiers.
Use Case	UC01.1.1.6: Accept registrations	The goal of this use case is to accept new and updated registration of identifiers.
Use Case	UC01.2: Manage patient demographics	The goal of this use case is to manage the demographic data of a patient.
Use Case	UC01.2.1: Record patient demographics	The goal of this use case is to record patient demographic information in an information system. It includes updating patient demographics. this use case may be accomplished by a direct user interface or by system to system communication.
Use Case	UC01.2.2: Request patient demographics	The goal of this use case is to request demographic information on a patient based on selected parameters. These parameters may be demographic or identifier. the identifier may be previously known by the consumer or obtained from an identifier supplier, such as an MPI.
Use Case	UC01.2.3: Return patient demographics	The goal of this use case is to return patient demographics in response to a request.
Use Case	UC01.2.4: Receive patient demographics	The goal of this use case is to receive patient demographics. This may occur after sending a request or be unsolicited.
Use Case	UC01.3: Deduplicate patients	The goal of this use case is to assure an unduplicated registry of persons (patients). This may be part of an MPI or other information system, including IIS.

Package: P02: Manage Immunization History

Notes: This package contains use cases related to recording, updating and retrieving immunization history.

Parent: PHER Immunization DAM Use Case

UC02 Manage Immunization History Use Case (Use Case Diagram)

This diagram shows the use cases and actors participating in management of Immunization Histories.

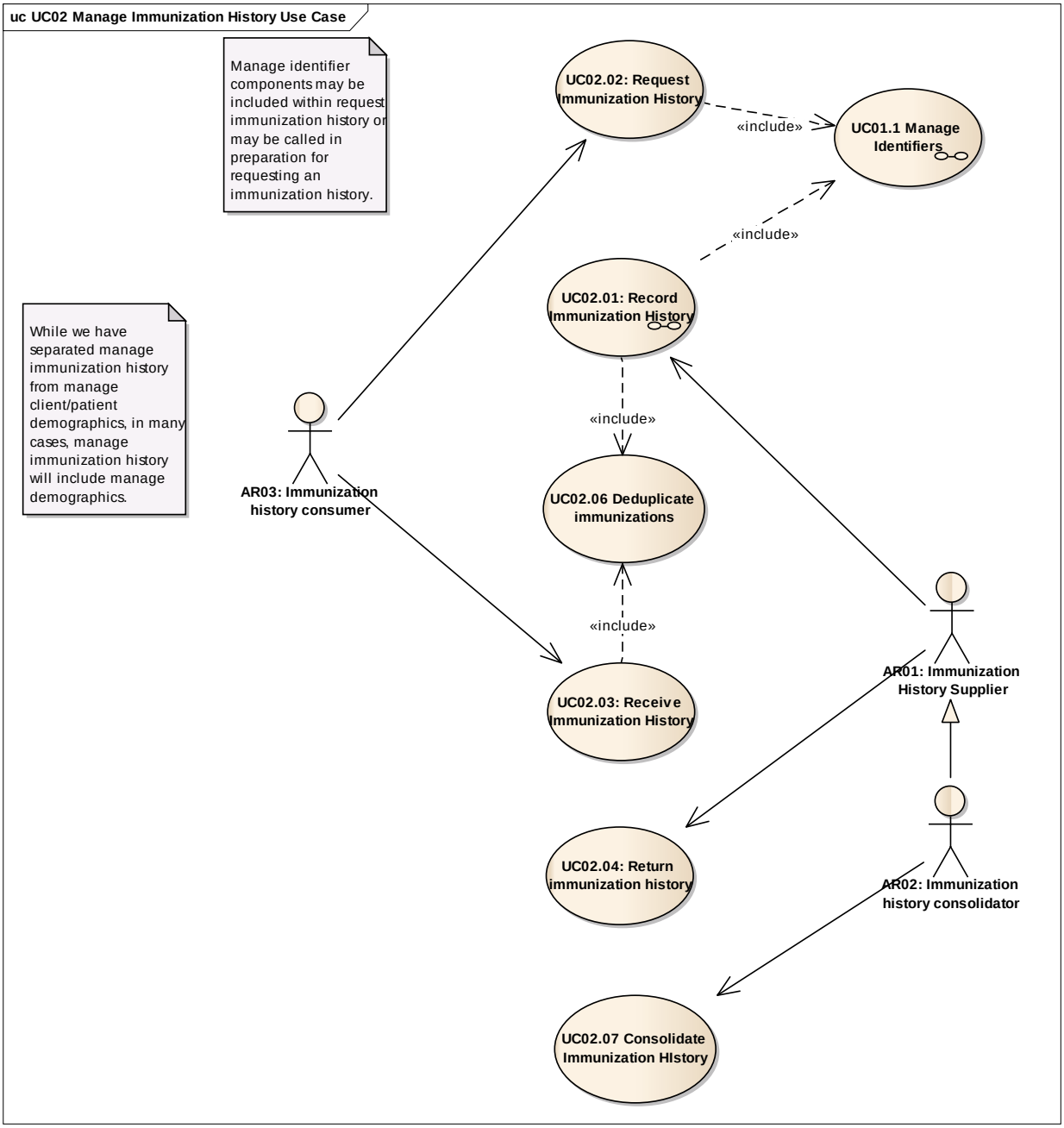

Figure: 5--UC02 Manage Immunization History Use Case

UC02.01 Record Immunization History (Use Case Diagram)

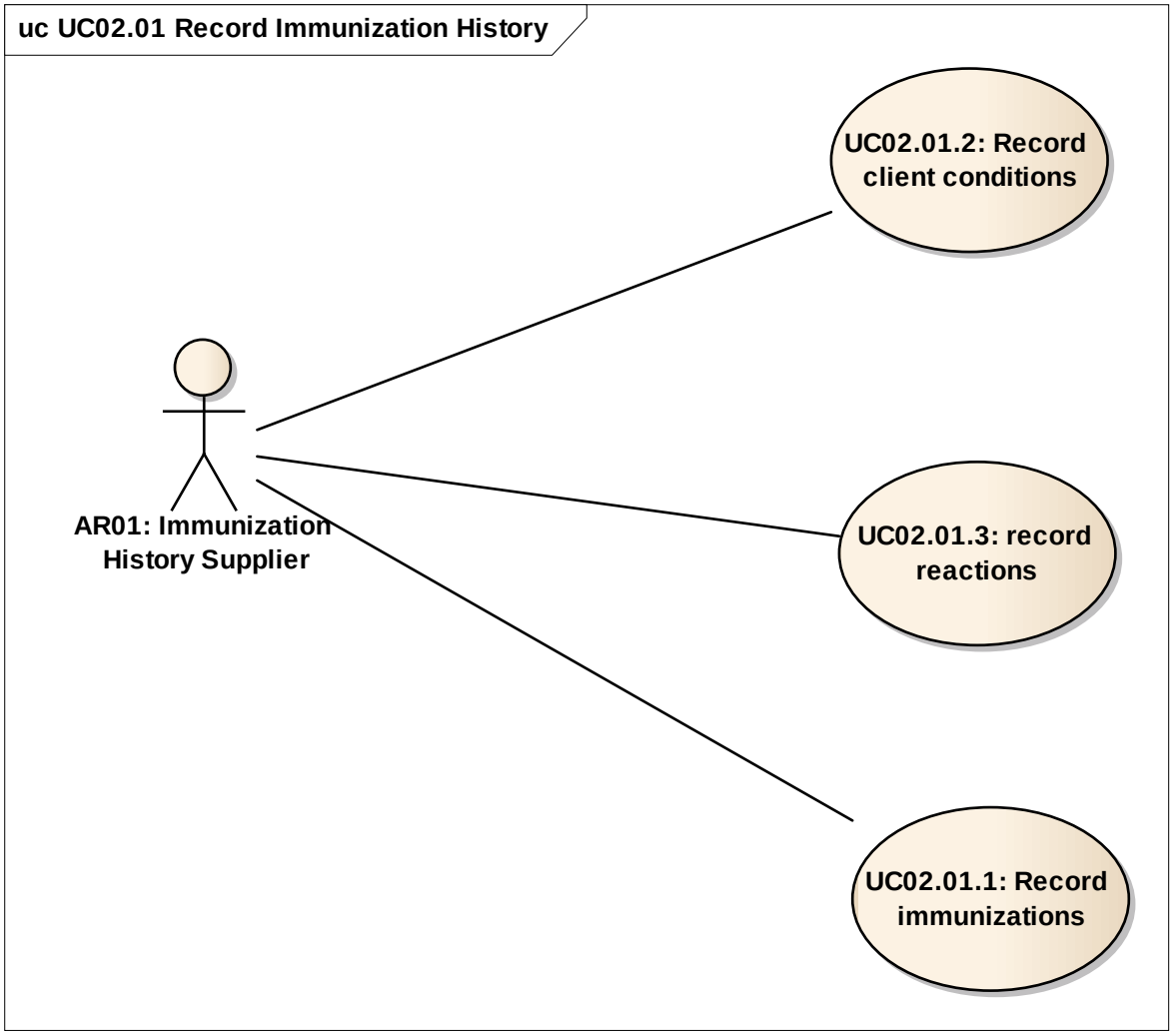

Figure: 6--UC02.01 Record Immunization History

UC01.1.1 Manage Identifies (Use Case Diagram)

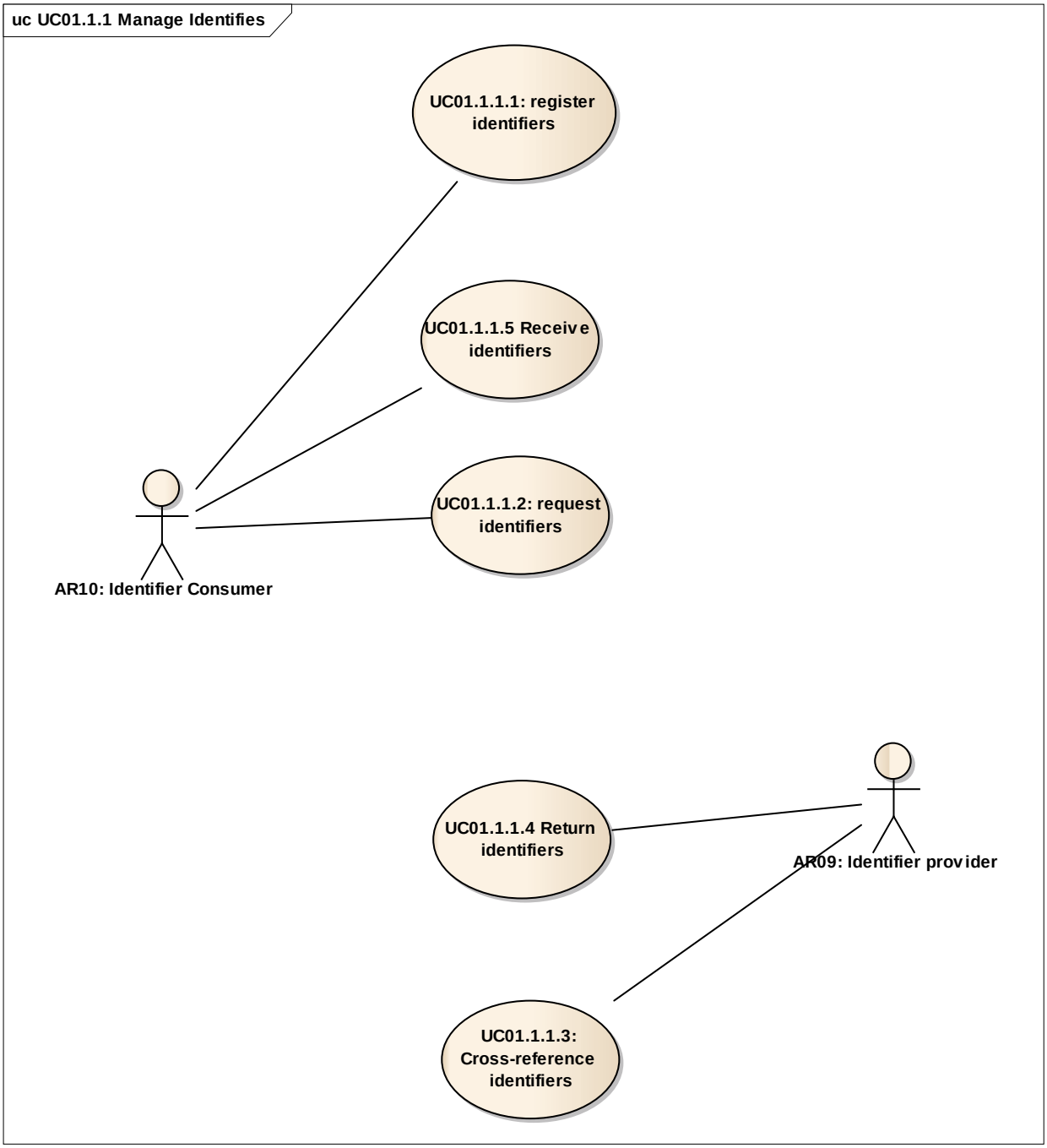

Figure: 7--UC01.1.1 Manage Identifies

Element Type	Name	Notes
Actor	A01: Immunization Information System	According to the CDC IISSB: Immunization Information Systems are confidential, population-based, computerized information systems that attempt to collect vaccination data about all children within a geographic area.
Actor	A12: Electronic Health Record	An electronic health record system is an

	System	information system which contains patient's medical records.
Actor	A17: PHR system	This is the Personal Health Record system. It houses a health record owned and maintained by the person it is about.
Actor	AR01: Immunization History Supplier	This actor supplies immunization data to other systems, particularly Immunization History consolidators.. Some of the immunization history suppliers include: • Electronic Health Record systems • Personal Health Record systems • Immunization Information Systems
Actor	AR09: Identifier provider	The goal of this actor is to be a register of identifiers. Entities that may play this role include: • Master patient index • IIS
Actor	AR10: Identifier Consumer	The goal of this actor is to use the services of an identifier provider. Among the entities that are likely to fulfill this role are: • EHR • IIS • PHR • Public health information systems • Health information exchange • Adverse event registry
Use Case	UC01.1 Manage Identifiers	The goal of this use case is to manage identifiers of patients.
Use Case	UC01.1.1.1: register identifiers	The goal of this use case is to register patient identifiers with an identity resolution system/service.
Use Case	UC01.1.1.2: request identifiers	The goal of this use case is to get identifiers for a patient based on specified parameters. The parameters may be demographic or may rely on

		cross-referencing identifiers.
Use Case	UC01.1.1.3: Cross-reference identifiers	The goal of this use case is to maintain a cross reference of patient identifiers.
Use Case	UC01.1.1.4 Return identifiers	The goal of this use case is to return patient identifiers in response to a request for identifiers.
Use Case	UC01.1.1.5 Receive identifiers	The goal of this use case is to receive identifiers from id source in response to a request for identifiers.
Use Case	UC01.1.1.6: Accept registrations	The goal of this use case is to accept new and updated registration of identifiers.
Use Case	UC02.01.1: Record immunizations	The goal of this use case is to record individual immunization records.
Use Case	UC02.01.2: Record client conditions	The goal of this use case is to record client conditions, such as allergies and immunities.
Use Case	UC02.01.3: record reactions	The goal of this use case is to record potential adverse events related in time with an immunization.
Use Case	UC02.01: Record Immunization History	The goal of this use case is to record immunization history in information system. An immunization history includes all immunizations, patient demographics and patient conditions. It may include functionality from record demographics use case. This use case may be accomplished by direct access via user interface or by system to system communication.
Use Case	UC02.02: Request Immunization History	The goal of this use case is to request a complete immunization history from an information system, based on specified parameters. These could be demographic information or patient identifiers known or obtained from MPI.
Use Case	UC02.03: Receive Immunization History	The goal of this use case is to receive an immunization history from another system. It could be unsolicited or in response to a query.
Use Case	UC02.04: Return immunization history	The goal of this use case is to return an immunization history in response to a request for immunization history.
Use Case	UC02.06 Deduplicate immunizations	The goal of this use case is to deduplicate immunization records.
Use Case	UC02.07 Consolidate Immunization History	The goal of this use case is to consolidate immunization information from different sources. It may accomplish this by storing them centrally, like an IIS, or it may keep track of where the original data are and get them when needed.

Package: P03: Clinical Decision Support

Notes: This package contains use cases related to immunization CDS. It does not contain use cases related to schedule development. Those use cases are found in a separate package.

Parent: PHER Immunization DAM Use Case

UC03 Clinical Decision Support (Use Case Diagram)

This diagram shows the use cases and actors participating in Clinical Decisions Support. It does not contain use cases related to schedule development.

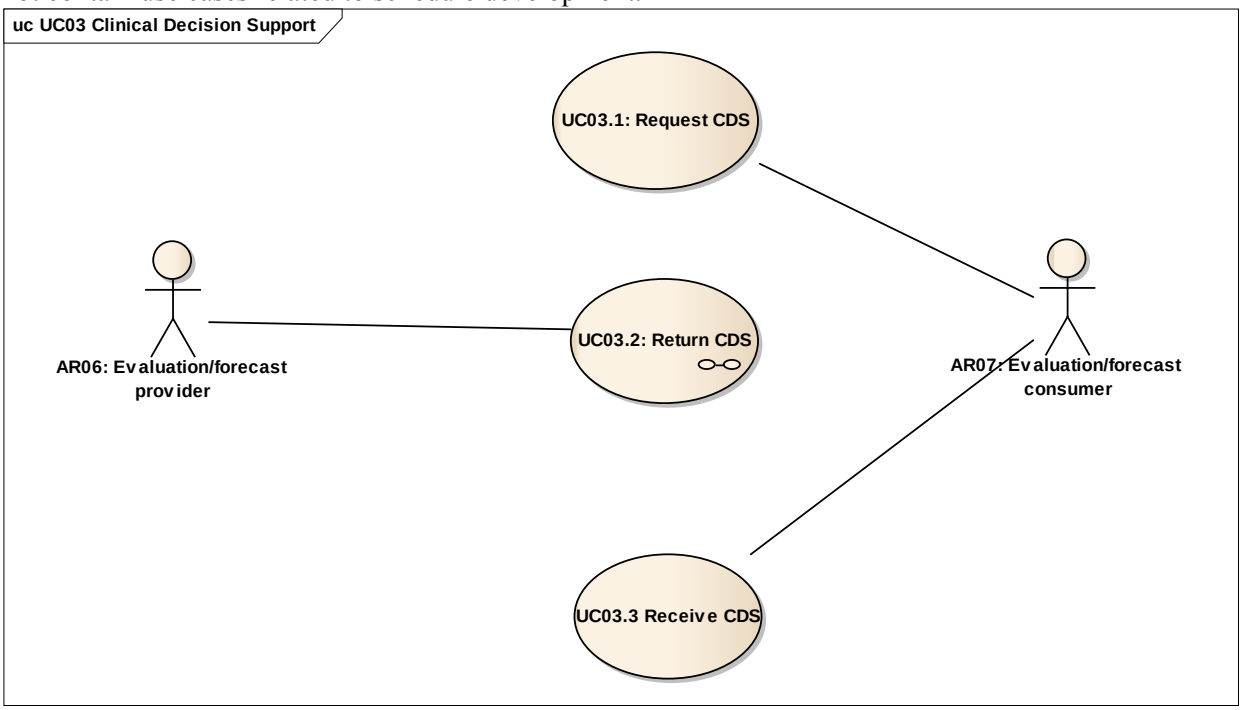

Figure: 8--UC03 Clinical Decision Support

UC03.2 Return CDS (Use Case Diagram)

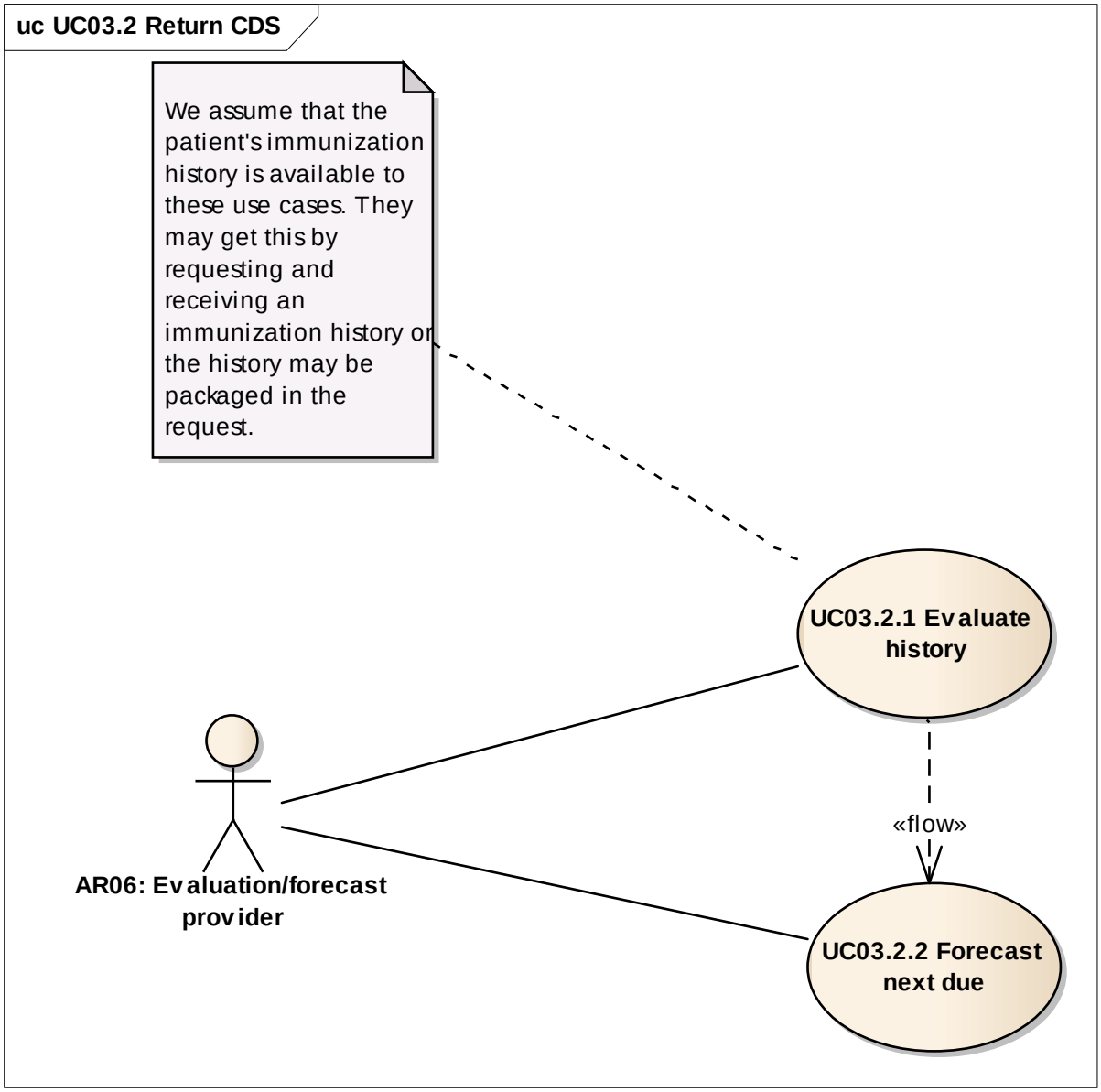

Figure: 9--UC03.2 Return CDS

Element Type	Name	Notes
Actor	AR06: Evaluation/forecast provider	This actor evaluates a patient's immunization history and other factors and produces a forecast of next doses due. It also returns the evaluation of the history. Actors who may play this role include: • IIS • CDS service

		• EHR
Actor	AR07: Evaluation/forecast consumer	This actor may represent any system which requests and receives CDS services. Actors who may play this role include: • EHR • PHR • HIE • IIS • School • Day care • Payer
Use Case	UC03.1: Request CDS	The goal of this use case is to request clinical decision support (evaluation and forecast) for a given patient. We assume that the pertinent immunization history is supplied to support this request.
Use Case	UC03.2: Return CDS	The goal of this use case is to return an evaluated immunization history and forecast of next doses due. We assume that an immunization history is available for the patient in question.
Use Case	UC03.2.1 Evaluate history	The goal of this use case is to evaluate the history based on the selected rule set/schedule.
Use Case	UC03.2.2 Forecast next due	The goal of this use case is to forecast the next doses due for the person based on the history and the specified rule set/schedule.
Use Case	UC03.3 Receive CDS	The goal of this use case is to receive the output of a CDS service.

Package: P04: Manage Adverse Event Reporting

Notes: This package contains use cases to reporting of adverse events.

Parent: PHER Immunization DAM Use Case

UC04 Manage Adverse Event Reporting (Use Case Diagram)

This diagram shows the use cases and actors participating in Adverse Event Reporting.

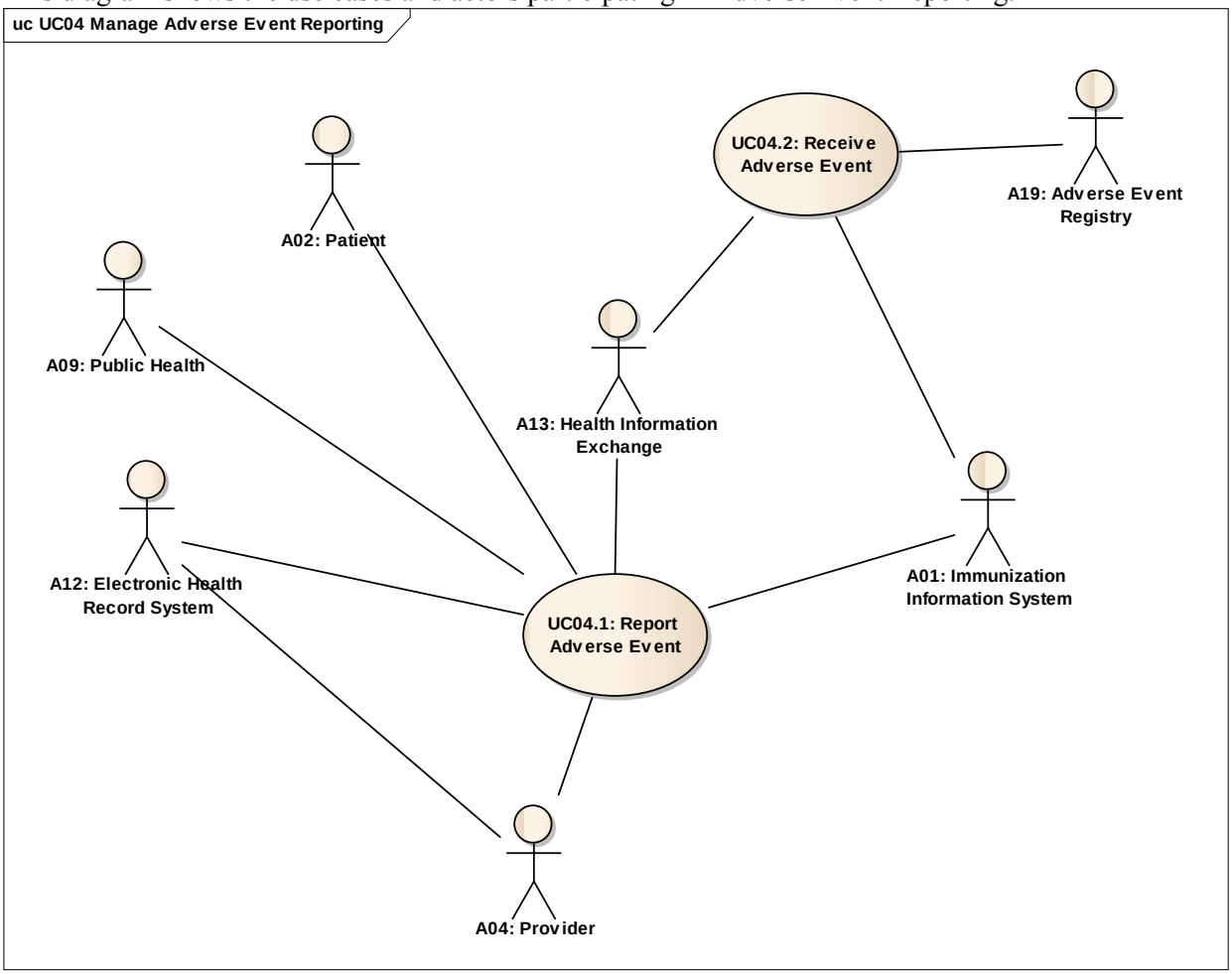

Figure: 10--UC04 Manage Adverse Event Reporting

Element Type	Name	Notes
Actor	A01: Immunization Information System	According to the CDC IISSB: Immunization Information Systems are confidential, population-based, computerized information systems that attempt to collect vaccination data about all persons within a geographic area.
Actor	A02: Patient	A patient is a person receiving health care. In our models, this is generally related to immunization.
Actor	A04: Provider	A provider is a person providing health care, that is a clinician.
Actor	A09: Public Health	Public Health (also known as population health) fulfills a number of roles related to immunization. It is concerned about promoting the health of the population.
Actor	A12: Electronic Health Record System	An electronic health record system is an information system which contains

		patient's medical records.
Actor	A13: Health Information Exchange	This actor acts as a hub to facilitate access to consolidated health records from multiple sources.
Actor	A19: Adverse Event Registry	This actor represents the system intended to capture and track adverse events. It is typically a national effort.
Use Case	UC04.1: Report Adverse Event	The goal of this is use case is to report adverse events. This can be either via direct interface or by electronic transmission.
Use Case	UC04.2: Receive Adverse Event	The goal of this use case is to receive adverse event information.

Package: P05: Manage Vaccine

Notes: This package contains use cases supporting Vaccine management. Includes manufacture, distribution and inventory management.

Parent: PHER Immunization DAM Use Case

UC05: Manage Vaccine (Use Case Diagram)

This diagram shows the use cases and actors participating in vaccine management.

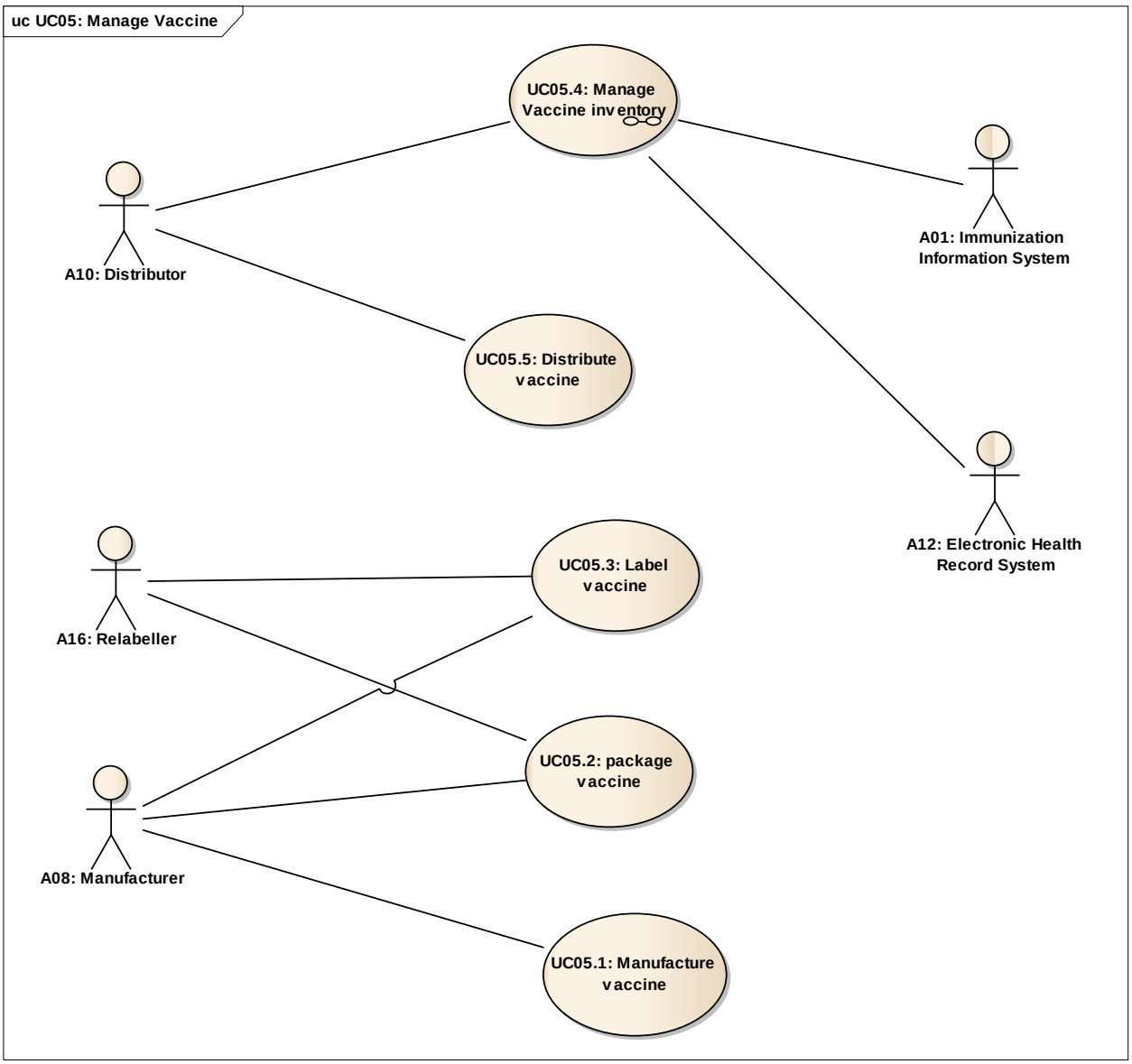

Figure: 11--UC05: Manage Vaccine

UC05.4 Manage Vaccine inventory (Use Case Diagram)

This Use Case diagram includes the activities associated with managing inventory in an information system.

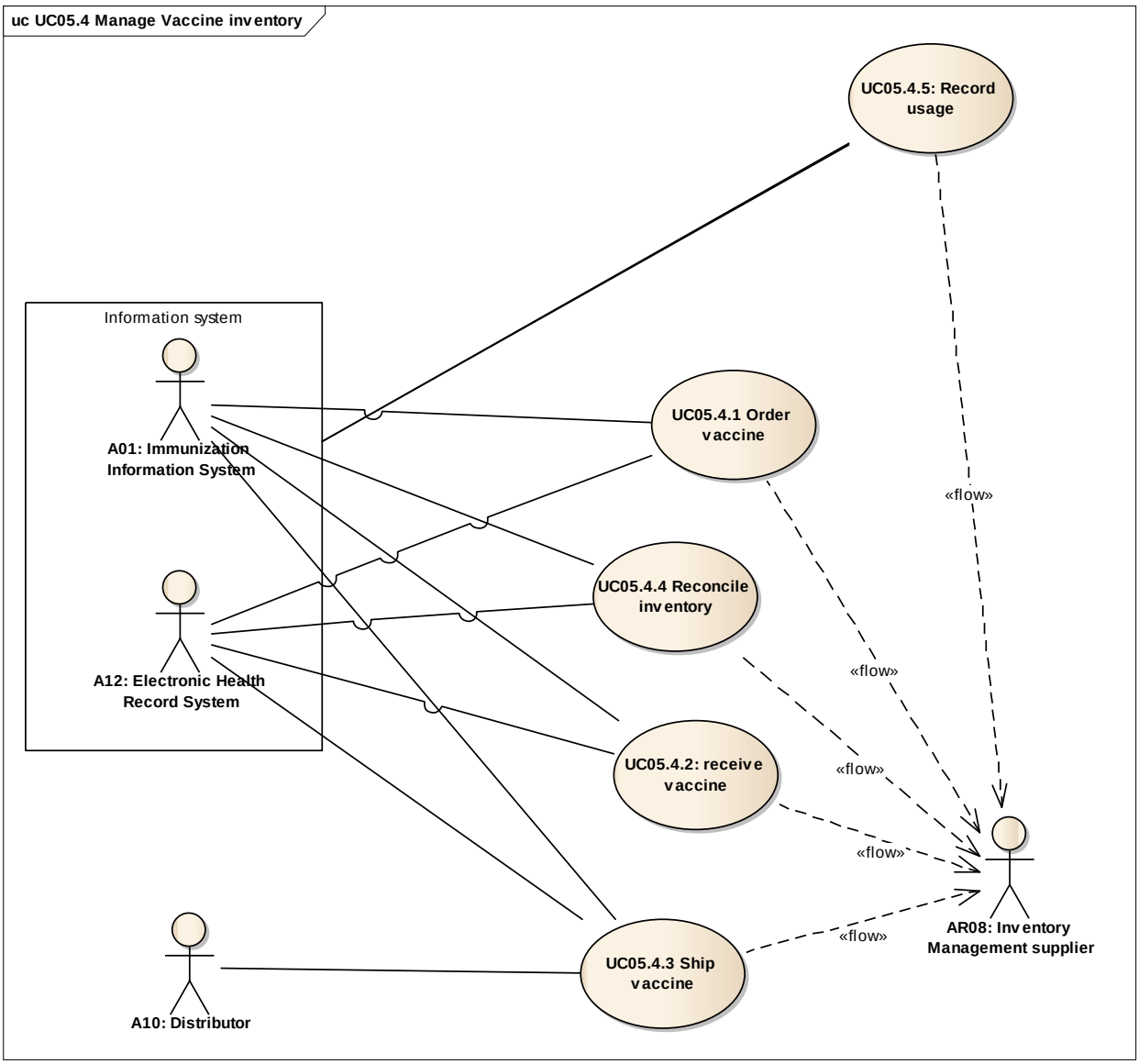

Figure: 12--UC05.4 Manage Vaccine inventory

Element Type	Name	Notes
Actor	A01: Immunization Information System	According to the CDC IISSB: Immunization Information Systems are confidential, population-based, computerized information systems that attempt to collect vaccination data about all persons within a geographic area.
Actor	A08: Manufacturer	A manufacturer makes products, vaccines in our case.
Actor	A10: Distributor	This actor distributes vaccine from manufacturer to end users.
Actor	A12: Electronic Health Record System	An electronic health record system is an information system which contains

		patient's medical records.
Actor	A16: Relabeller	A relabeller repackages vaccines and sells them under their label.
Actor	AR08: Inventory Management supplier	This actor tracks vaccine inventory. It tracks orders, shipments, transfers, wastage, usage. Some systems which may play this role include: • IIS • EHR • Distributor
Use Case	UC05.1: Manufacture vaccine	The goal of this use case is to make vaccine.
Use Case	UC05.2: package vaccine	The goal of this use case is package vaccine for distribution.
Use Case	UC05.3: Label vaccine	The goal of this use case is to label vaccine for distribution.
Use Case	UC05.4: Manage Vaccine inventory	The goal of this use case is to manage inventory of vaccine. This includes ordering, accepting, decrementing (use or waste) and transferring vaccine inventory.
Use Case	UC05.4.1 Order vaccine	The goal of this use case is to order vaccine from a supplier.
Use Case	UC05.4.2: receive vaccine	The goal of this use case is to receive vaccine and record into inventory.
Use Case	UC05.4.3 Ship vaccine	The goal of this use case is to ship or transfer vaccine from one inventory to another.
Use Case	UC05.4.4 Reconcile inventory	The goal of this use case is to reconcile actual stock on hand with inventory.
Use Case	UC05.4.5: Record usage	The goal of this use case is record vaccine usage. When a dose is administered or wasted, it is recorded.
Use Case	UC05.5: Distribute vaccine	The goal of this use case is to distribute vaccine to provider organizations.It includes activiies such as relabelling.

Package: P06: Clinical Care

Notes: This package contains use cases related to clinical care and immunization. These use cases represent the actual care given to the patient.

Parent: PHER Immunization DAM Use Case

UC06 Clinical Care (Use Case Diagram)

This diagram shows the clinical care activities related to immunization. These use cases represent the actual care given to the patient.

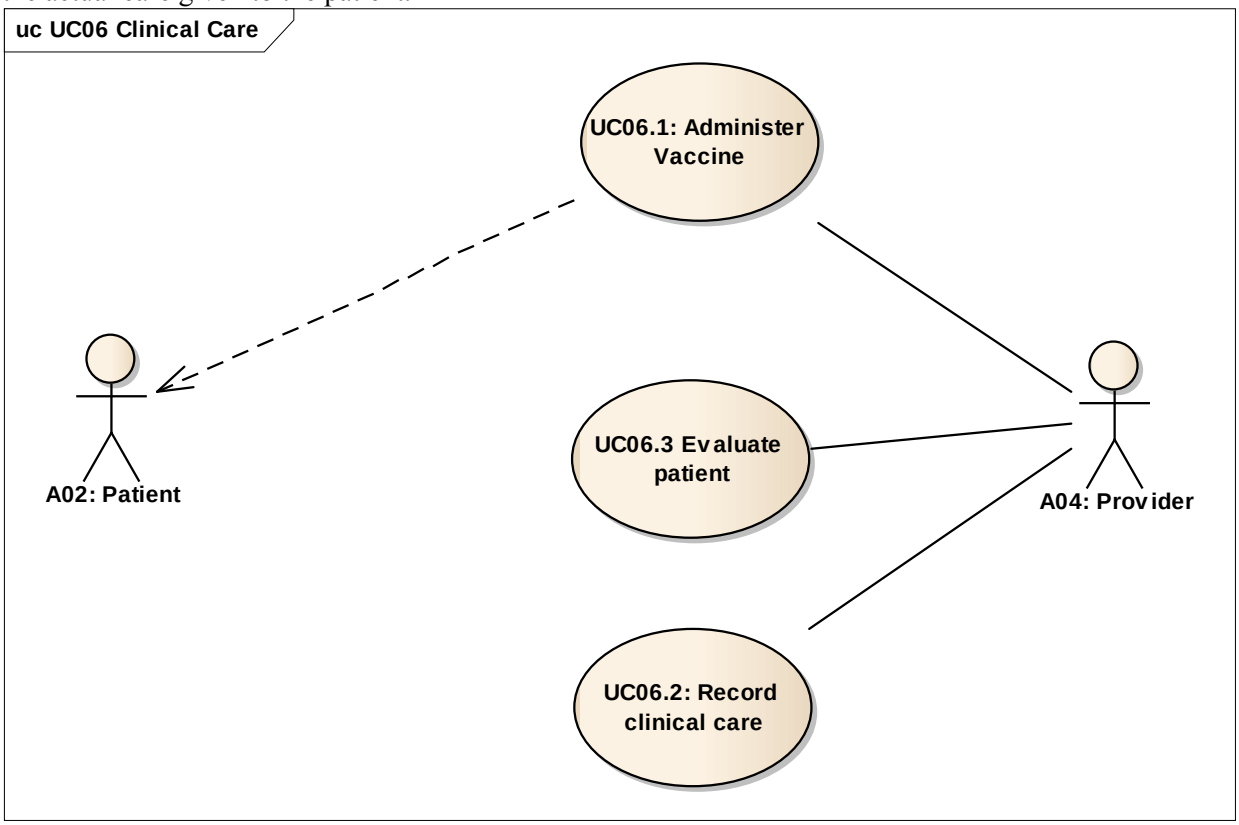

Figure: 13--UC06 Clinical Care

UC06.04 Evaluate patient (Use Case Diagram)

The goal of this use case is to evaluate the immunization needs of a patient.

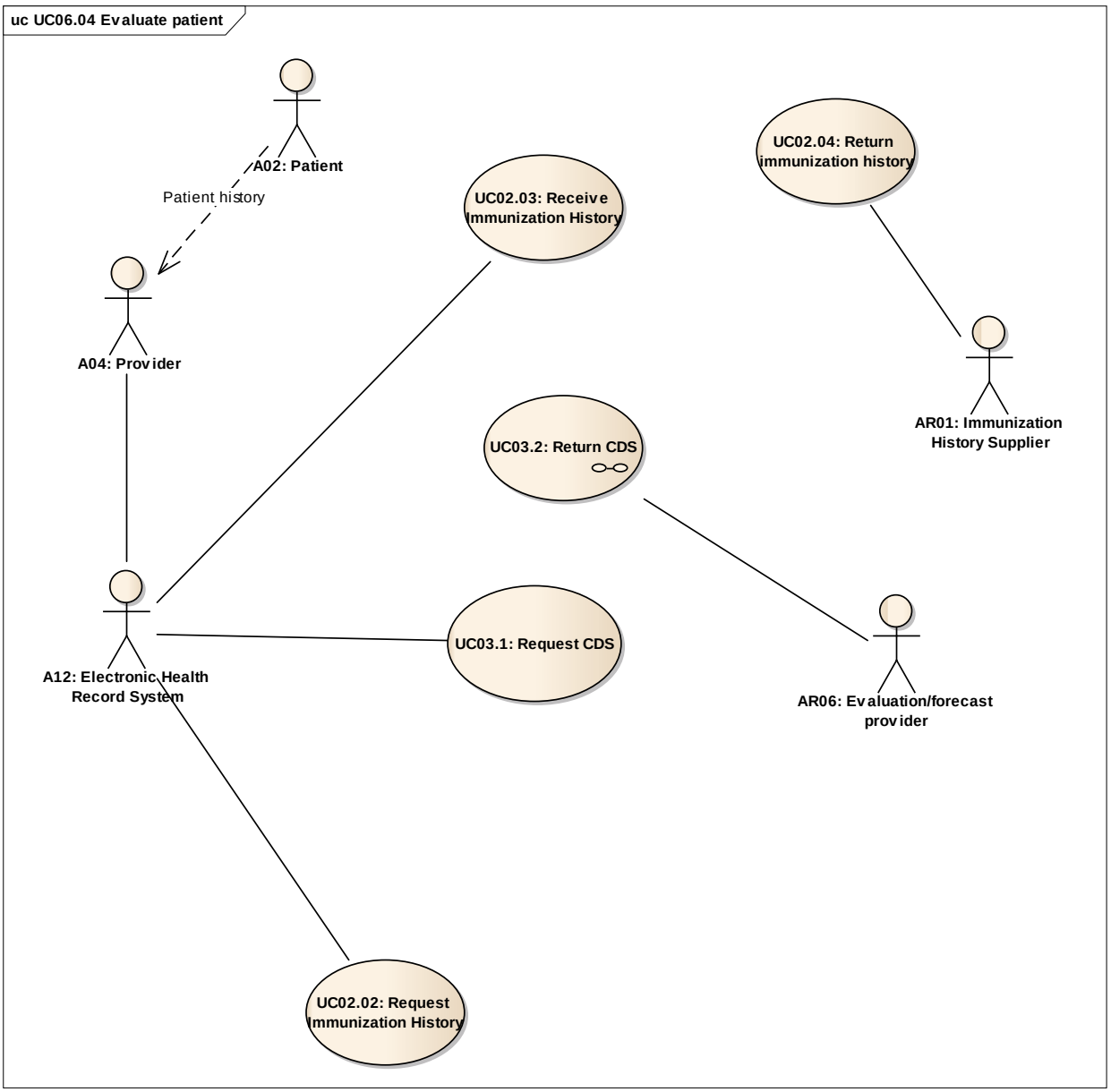

Figure: 14--UC06.04 Evaluate patient

Element Type	Name	Notes
Actor	A02: Patient	A patient is a person receiving health care. In our models, this is generally related to immunization.
Actor	A02: Patient	A patient is a person receiving health care. In our models, this is generally related to immunization.
Actor	A03: Patient Registry	A patient registry is an information system with the goal of maintaining demographic information about a patient. Included in this function is tracking identifiers from different sources.

Actor	A04: Provider	A provider is a person providing health care, that is a clinician.
Actor	A12: Electronic Health Record System	An electronic health record system is an information system which contains patient's medical records.
Actor	AR01: Immunization History Supplier	This actor supplies immunization data to other systems, particularly Immunization History consolidators.. Some of the immunization history suppliers include: • Electronic Health Record systems • Personal Health Record systems • Immunization Information Systems
Actor	AR06: Evaluation/forecast provider	This actor evaluates a patient's immunization history and other factors and produces a forecast of next doses due. It also returns the evaluation of the history. Actors who may play this role include: • IIS • CDS service • EHR
Use Case	UC06.1: Administer Vaccine	The goal of this use case is to administer vaccine to a patient.
Use Case	UC06.2: Record clinical care	The goal of this use case is to record clinical care, usually in EHR. We do not go into great depth here as that is part of another Domain Analysis Model.
Use Case	UC06.3 Evaluate patient	The goal of this use case is to evaluate a patient's condition in order to determine if immunization is appropriate. We will not elaborate as this belongs in another Domain Analysis model.
Use Case	UC02.02: Request Immunization History	The goal of this use case is to request a complete immunization history from an information system, based on specified parameters. These could be demographic information or patient identifiers known or obtained from MPI.
Use Case	UC02.03: Receive Immunization History	The goal of this use case is to receive an immunization history from another system. It could be unsolicited or in response to a query.

Use Case	UC02.04: Return immunization history	The goal of this use case is to return an immunization history in response to a request for immunization history.
Use Case	UC03.1: Request CDS	The goal of this use case is to request clinical decision support (evaluation and forecast) for a given patient. We assume that the pertinent immunization history is supplied to support this request.
Use Case	UC03.2: Return CDS	The goal of this use case is to return an evaluated immunization history and forecast of next doses due. We assume that an immunization history is available for the patient in question.

Package: P07: Manage Reports

Notes: This package contains use cases related to a wide variety of reports.

Parent: PHER Immunization DAM Use Case

UC07.3 Create report (Use Case Diagram)

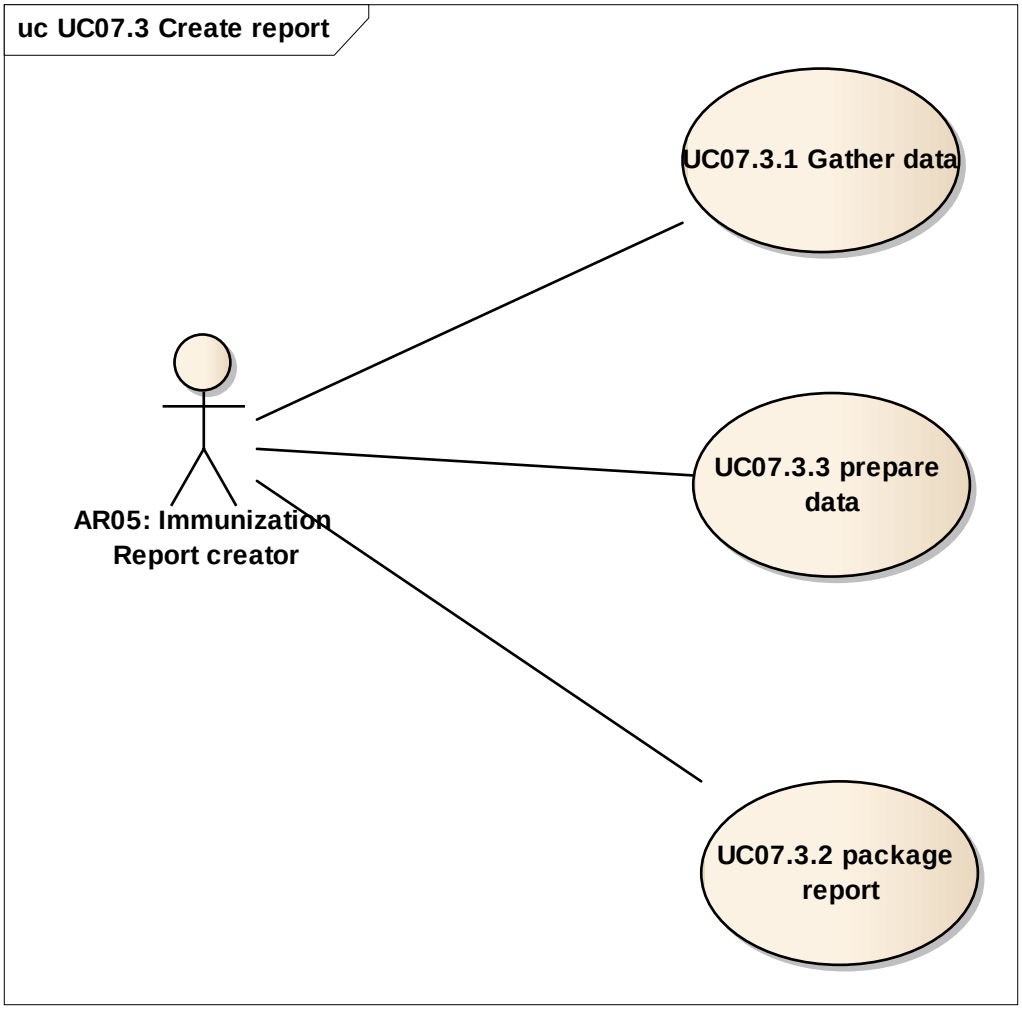

Figure: 15--UC07.3 Create report

UC07: Manage Reports (Use Case Diagram)

This diagram contains use cases related to a wide variety of reports. These use cases illustrate the basic process of report creation.

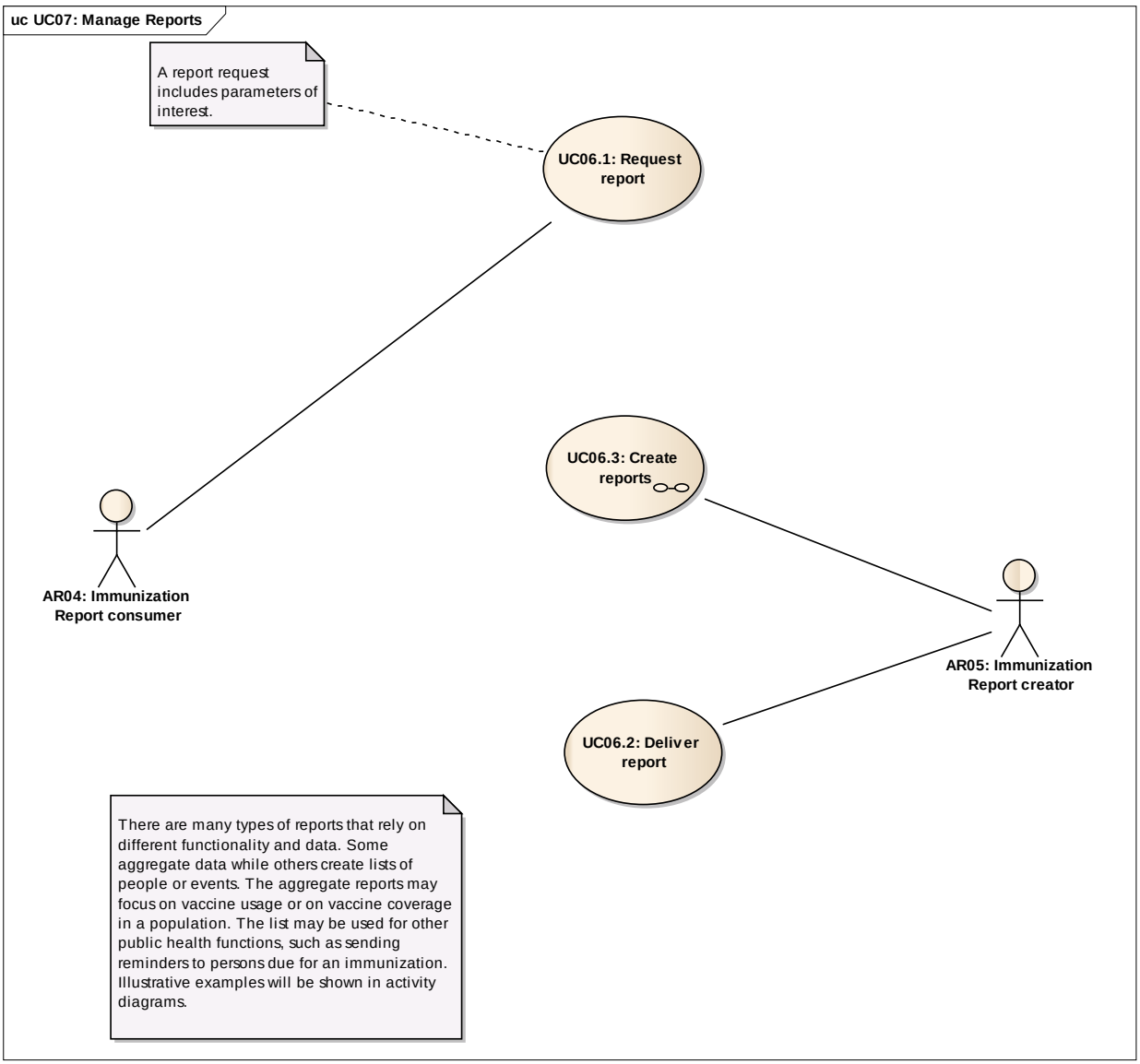

Figure: 16--UC07: Manage Reports

Element Type	Name	Notes
Actor	AR03: Immunization history consumer	This actor is interested in using / getting consolidated immunization history for individuals. Actors who may play this role include: • EHR • PHR • IIS • Patient • Provider • Public Health • Schools • Daycare

		• Camps • Payor • Employer • Evaluation and forecasting provider • Adverse Event registry
Actor	AR04: Immunization Report consumer	This actor requests and uses immunization reports. Actors who may play this role include: • EHR • PHR • Patient • Provider • Public Health • Government Payer • Non-governmental Payer • Government agency • Adverse Event registry
Use Case	UC07.1: Request report	The goal of this use case is to request a report.
Use Case	UC07.2: Deliver report	The goal of this use case is to deliver a report . This report may be in response to a request/query or be unsolicited.
Use Case	UC07.3.1 Gather data	The goal of this use case is to data of interest, based on specified parameters.
Use Case	UC07.3.2 package report	The goal of this use case is to package the report for return.
Use Case	UC07.3.3 prepare data	The goal of this use case is to prepare data for use by a report. This might include calculations, calls to CDS service, sorting or other processing.
Use Case	UC07.3: Create reports	The goal of this use case is to create reports (aggregate and list) based on specified parameters. It may include coverage reports, vaccine usage reports, vaccine availability reports, etc.

Package: P08: Manage CDS Rules

Notes: This package contains use cases related to creating and maintaining immunization schedule rules.

Parent: PHER Immunization DAM Use Case

UC08: Manage CDS Rules (Use Case Diagram)

This diagram shows the use cases and actors participating in management of rules and supporting data required by Clinical Decisions Support.

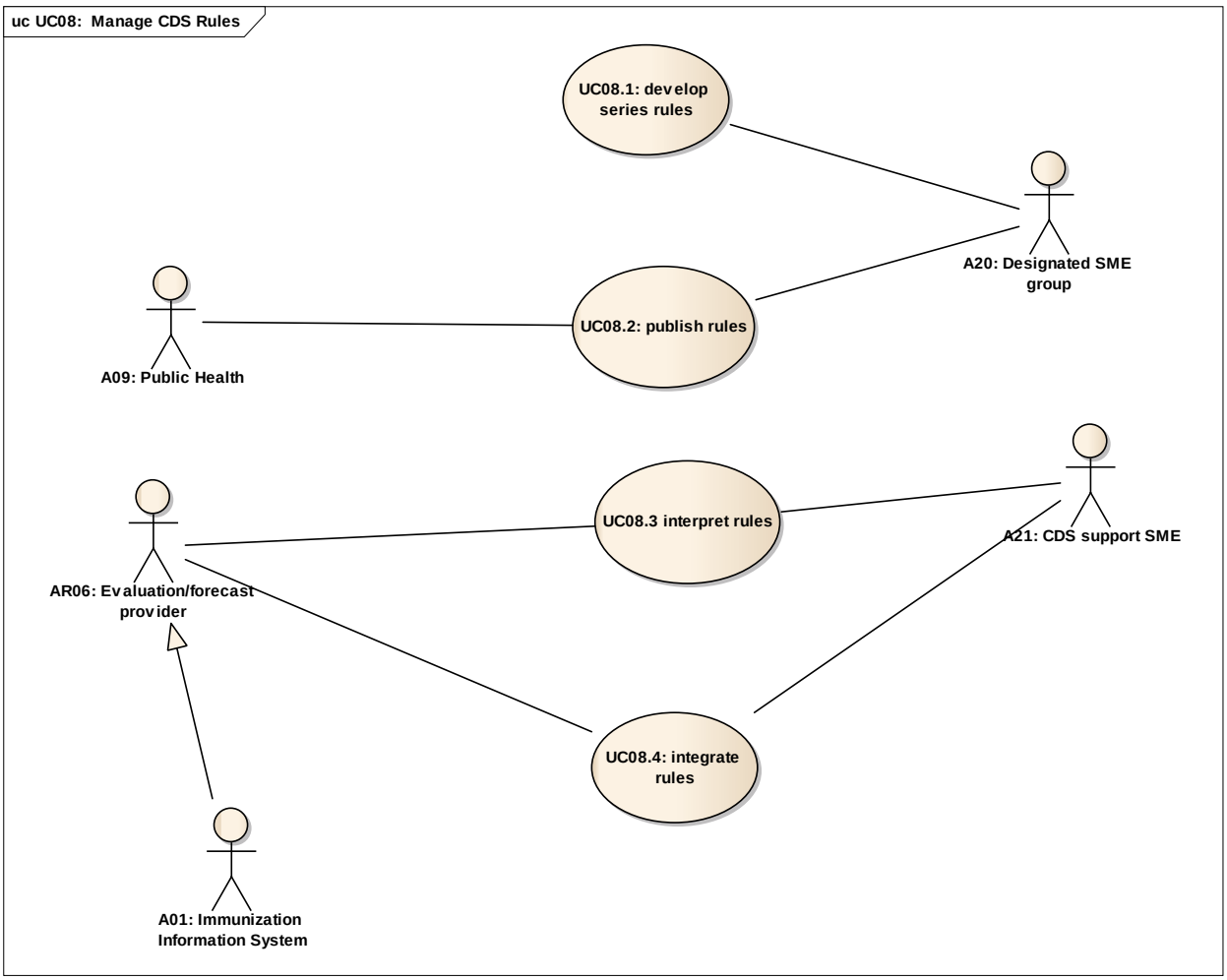

Figure: 17--UC08: Manage CDS Rules

Element Type	Name	Notes
Actor	A01: Immunization Information System	According to the CDC IISSB: Immunization Information Systems are confidential, population-based, computerized information systems that attempt to collect vaccination data about all persons within a geographic area.
Actor	A19: Adverse Event Registry	This actor represents the system intended to capture and track adverse events. It is typically a national effort.
Actor	A20: Designated SME group	This is the group of clinical SME responsible for rule development. An example in the US would be the ACIP.
Actor	A21: CDS support SME	This is a SME who integrates series rules into CDS engine.
Actor	AR05: Immunization Report creator	This actor supplies immunization reports. It requires participation of an Immunization History Consolidator in

		most cases. Actors who may play this role include: • IIS • HIE • EHR • Public Health
Use Case	UC08.1: develop series rules	The goal of this use case is to develop the rules used by CDS to evaluate immunization histories and forecast next dose.
Use Case	UC08.2: publish rules	The goal of this use case is publish the series rules developed to guide immunization practices.
Use Case	UC08.3 interpret rules	The goal of this use case is to interpret the published rules.
Use Case	UC08.4: integrate rules	The goals of this use case are to integrate the series rules as published.

Package: P09: transform format

Notes: This use case moves data from one format to another. In the HL7 world, this might be from V2 message to V3 document.

Parent: PHER Immunization DAM Use Case

P09: transform format (Use Case Diagram)

This use case package transforms data from one format to another. For instance a CDA document may be transformed to a Version 2.5.1 message.

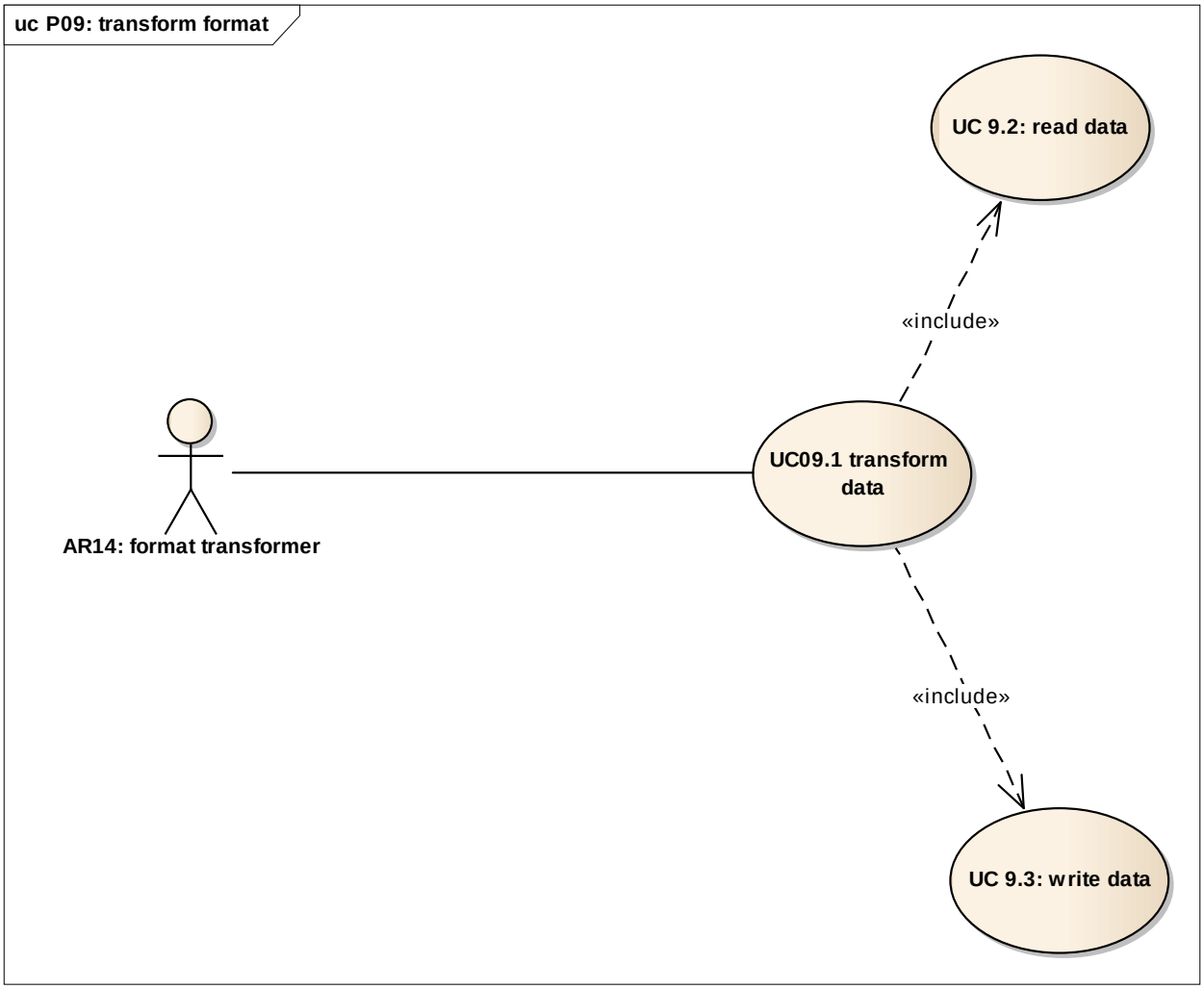

Figure: 18--P09: transform format

Element Type	Name	Notes
Actor	AR13: Demographic supplier	The goal of this actor is to supply demographic information to other actors. Entities that may play this role include: • IIS • EHR • PHR • Vital Records System
Use Case	UC09.1 transform data	This use case transforms data in one format to another.
Use Case	UC 9.2: read data	This use case reads the incoming data object.

Use Case	UC 9.3: write data	This use case writes the transformed data to the new format.

Activity Diagrams:

F01: Manage Patient Information (Package Diagram)

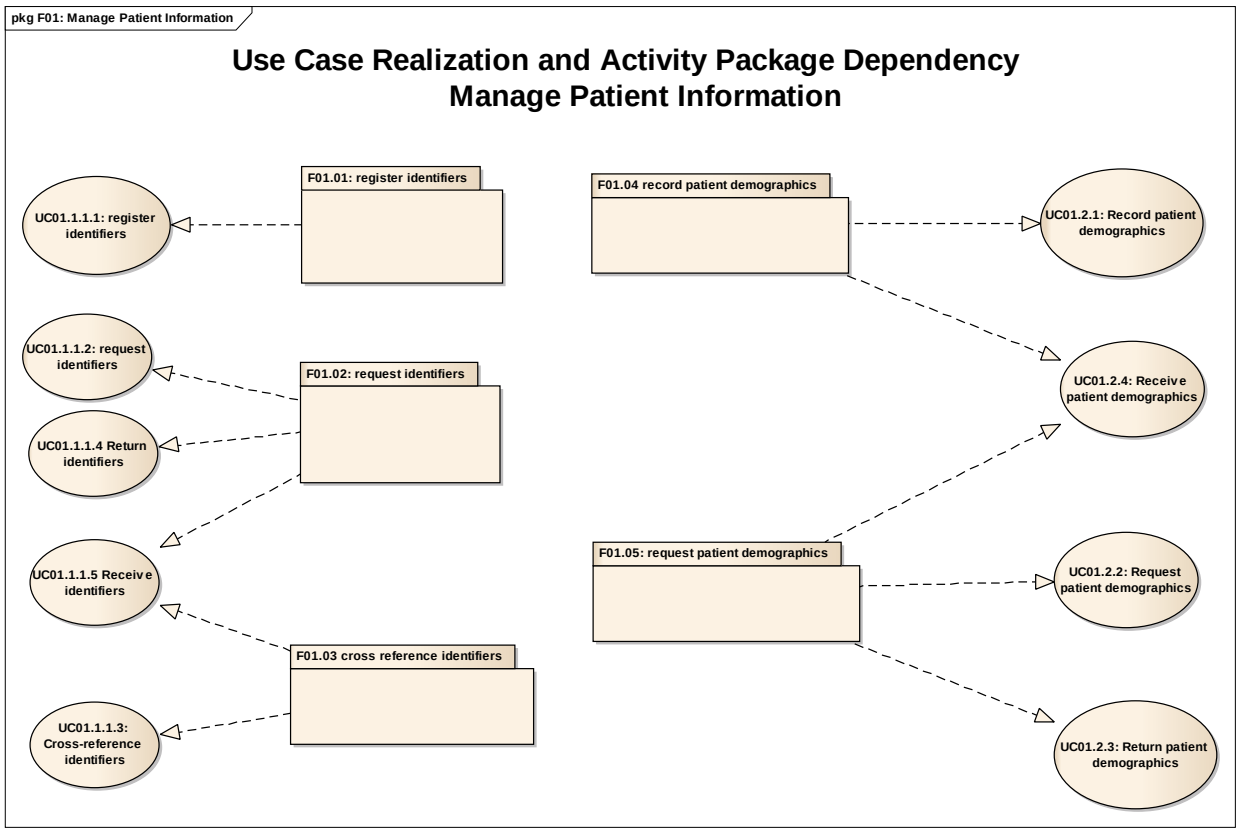

Figure: 1

F02: Manage Immunization History (Package Diagram)

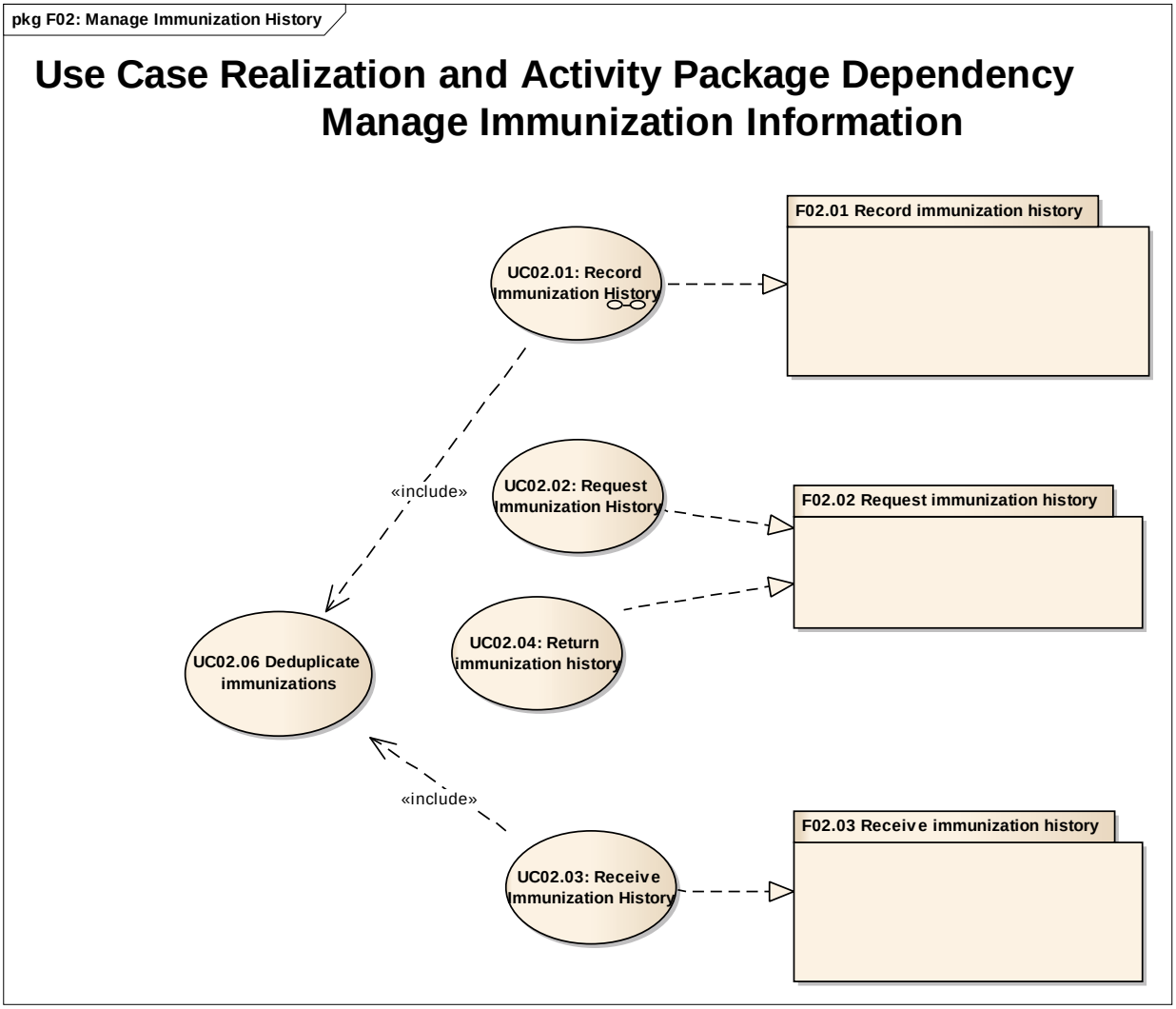

Figure: 2

F03: Clinical Decision Support (Package Diagram)

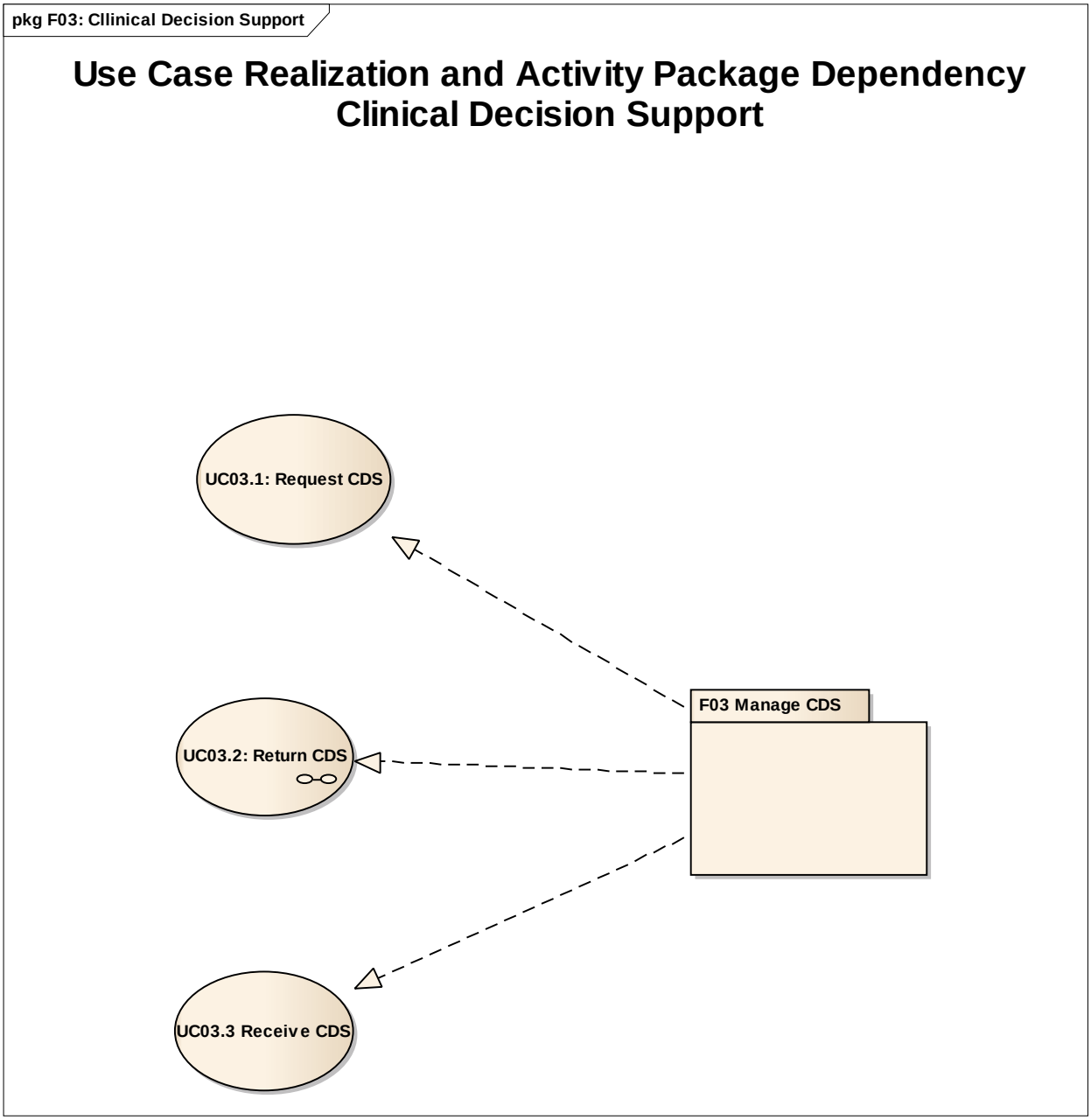

Figure: 3

F04: Manage Adverse Event Reporting (Package Diagram)

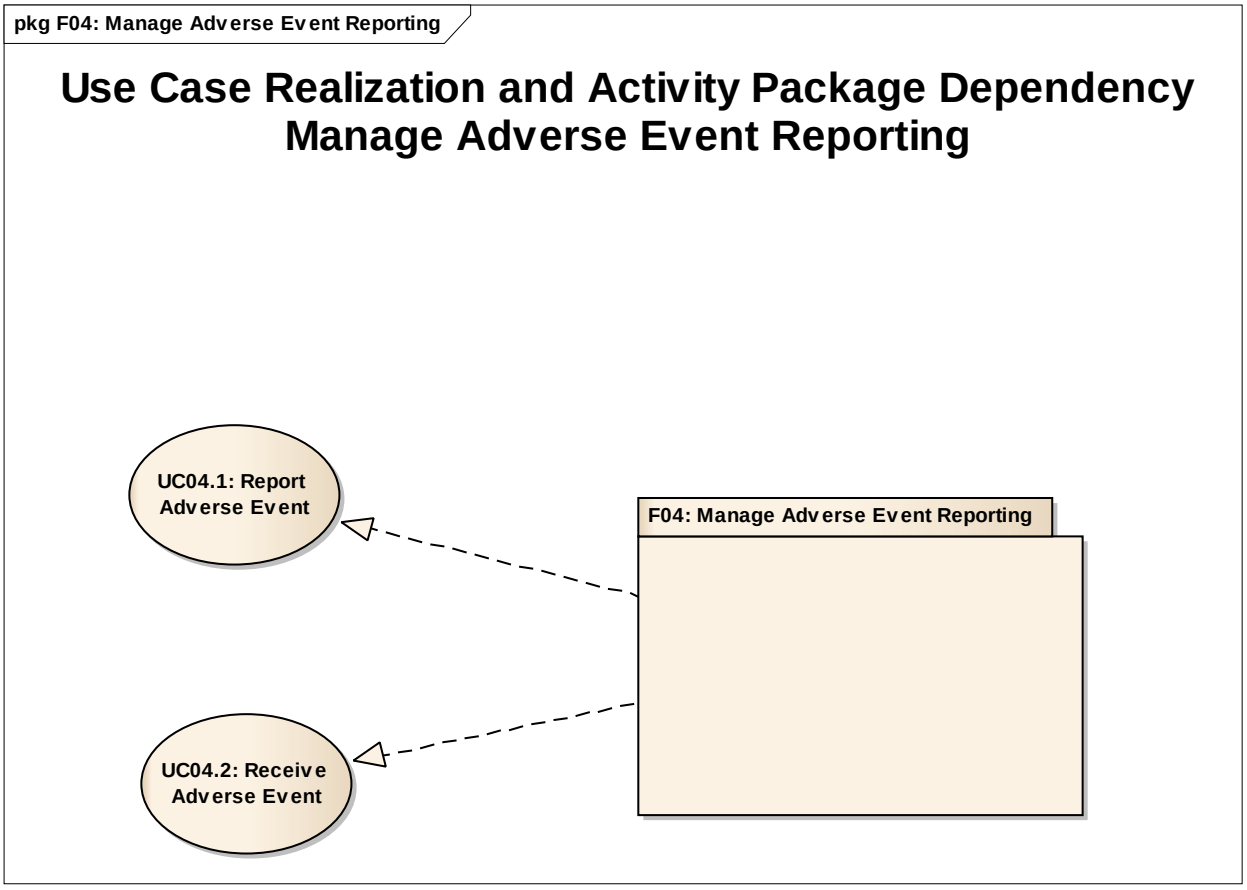

Figure: 4

F05.4: Manage Vaccine Inventory (Package Diagram)

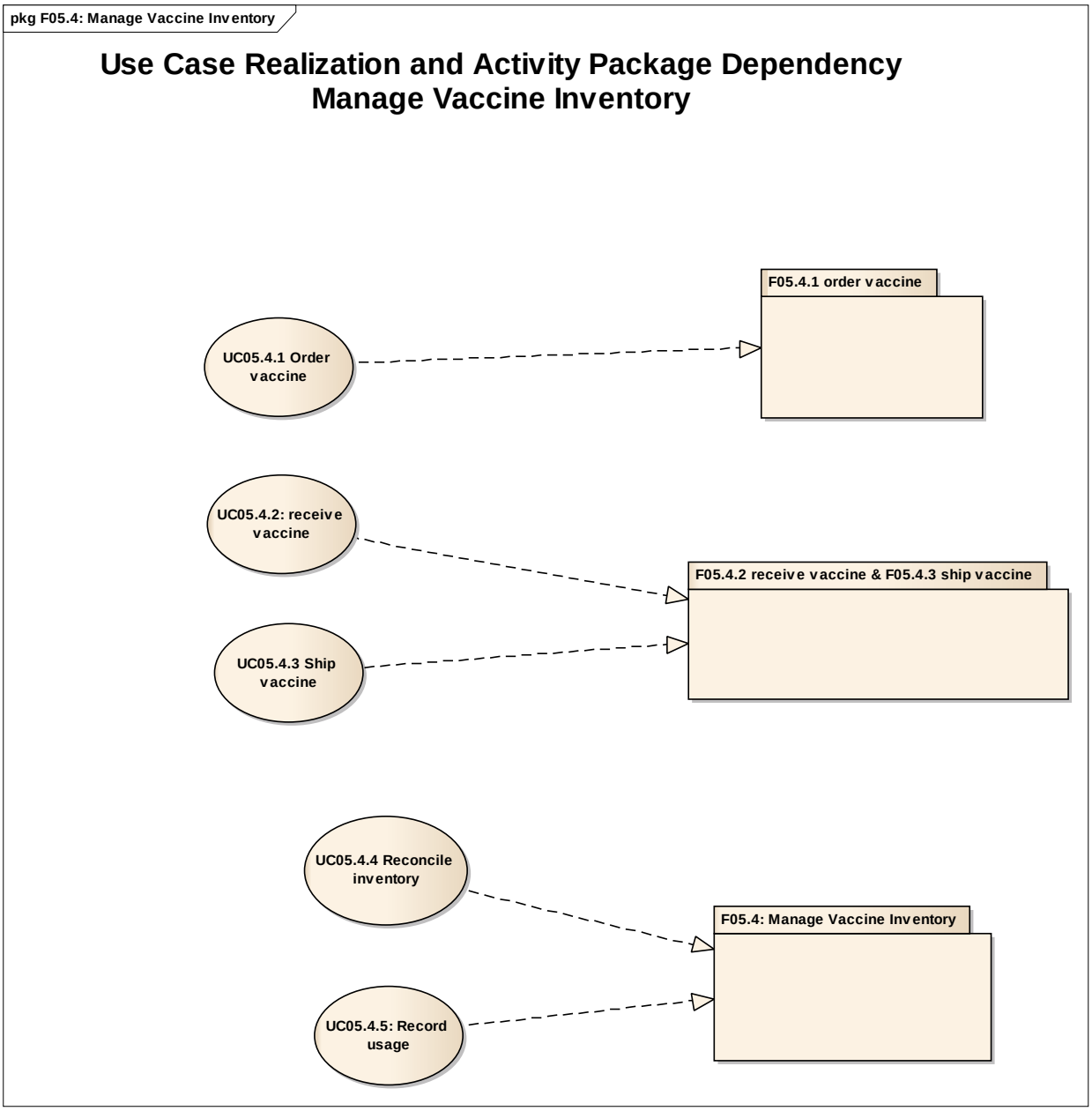

Figure: 5

F06: Clinical Care (Package Diagram)

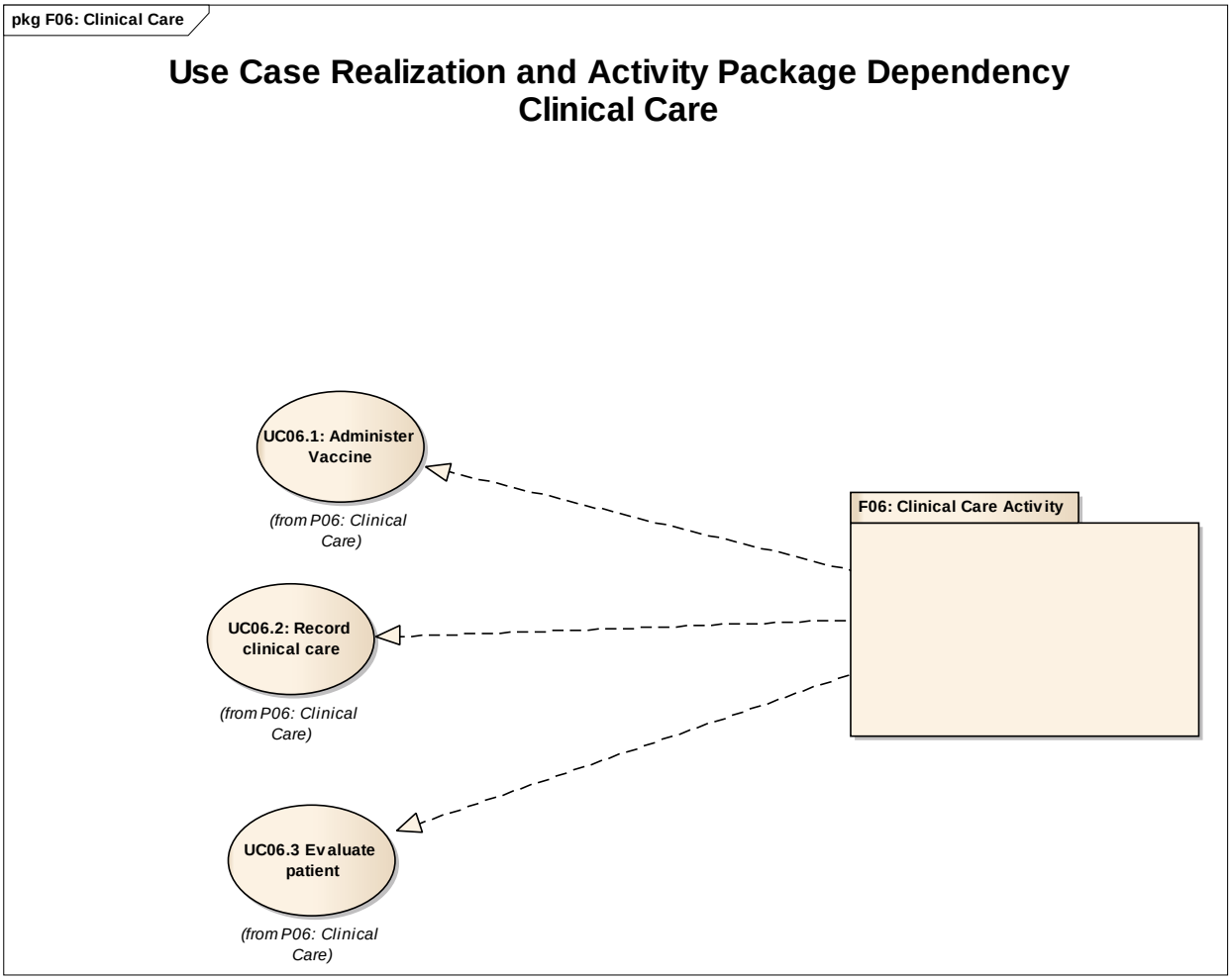

Figure: 6

F07: Manage Reports (Package Diagram)

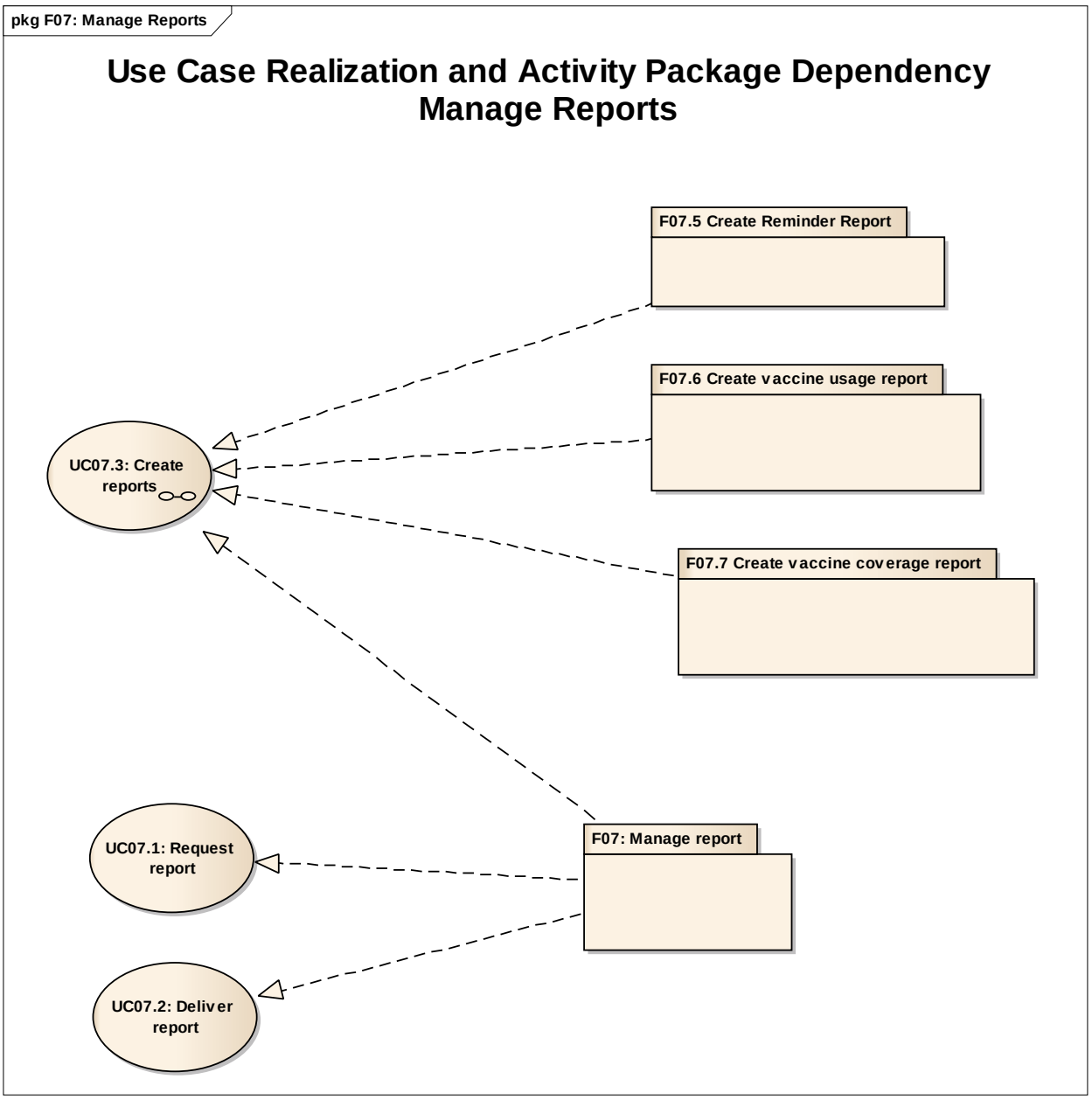

Figure: 7

F08: Manage CDS rules (Package Diagram)

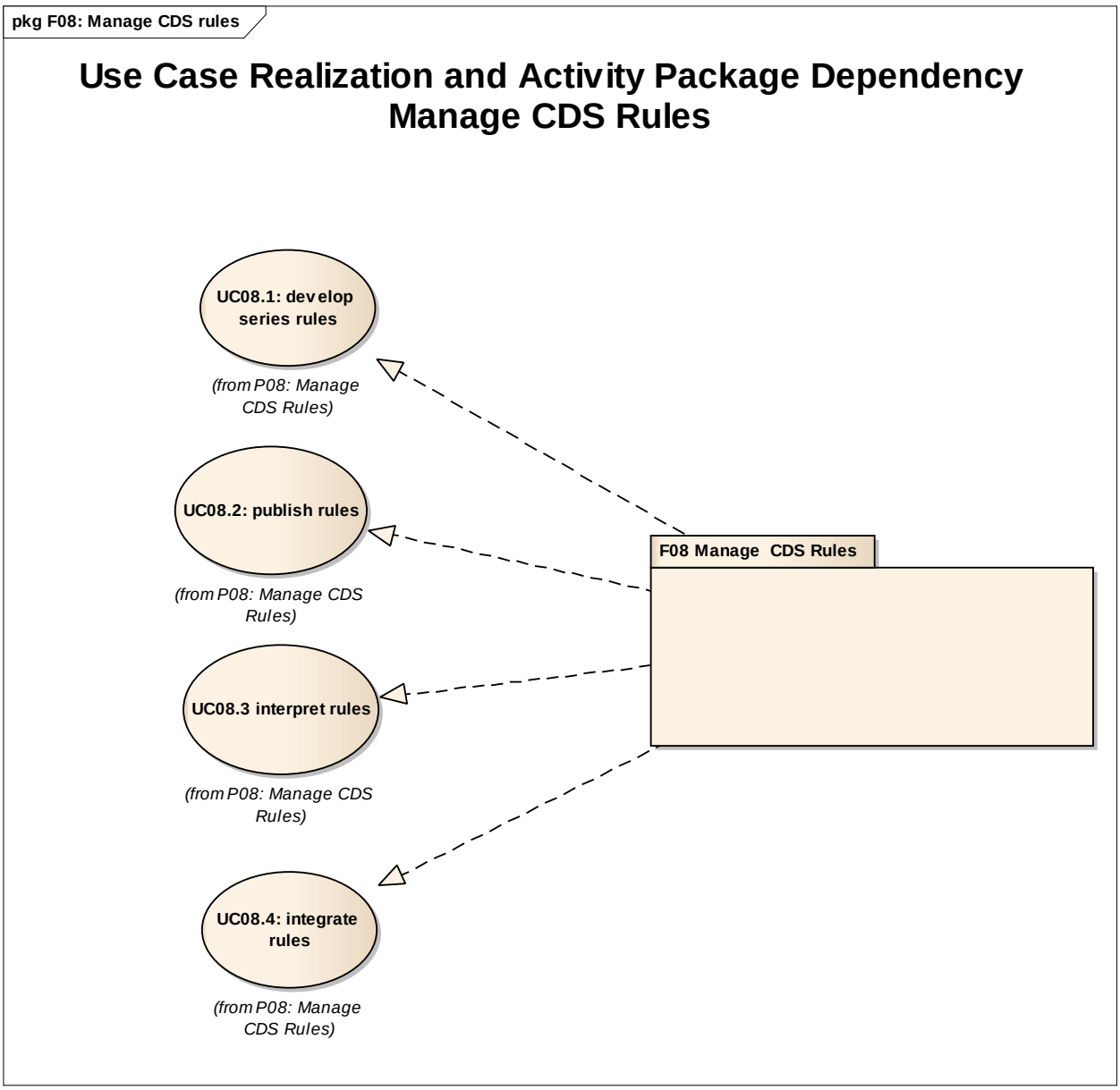

Figure: 8

F09: Transform format (Package Diagram)

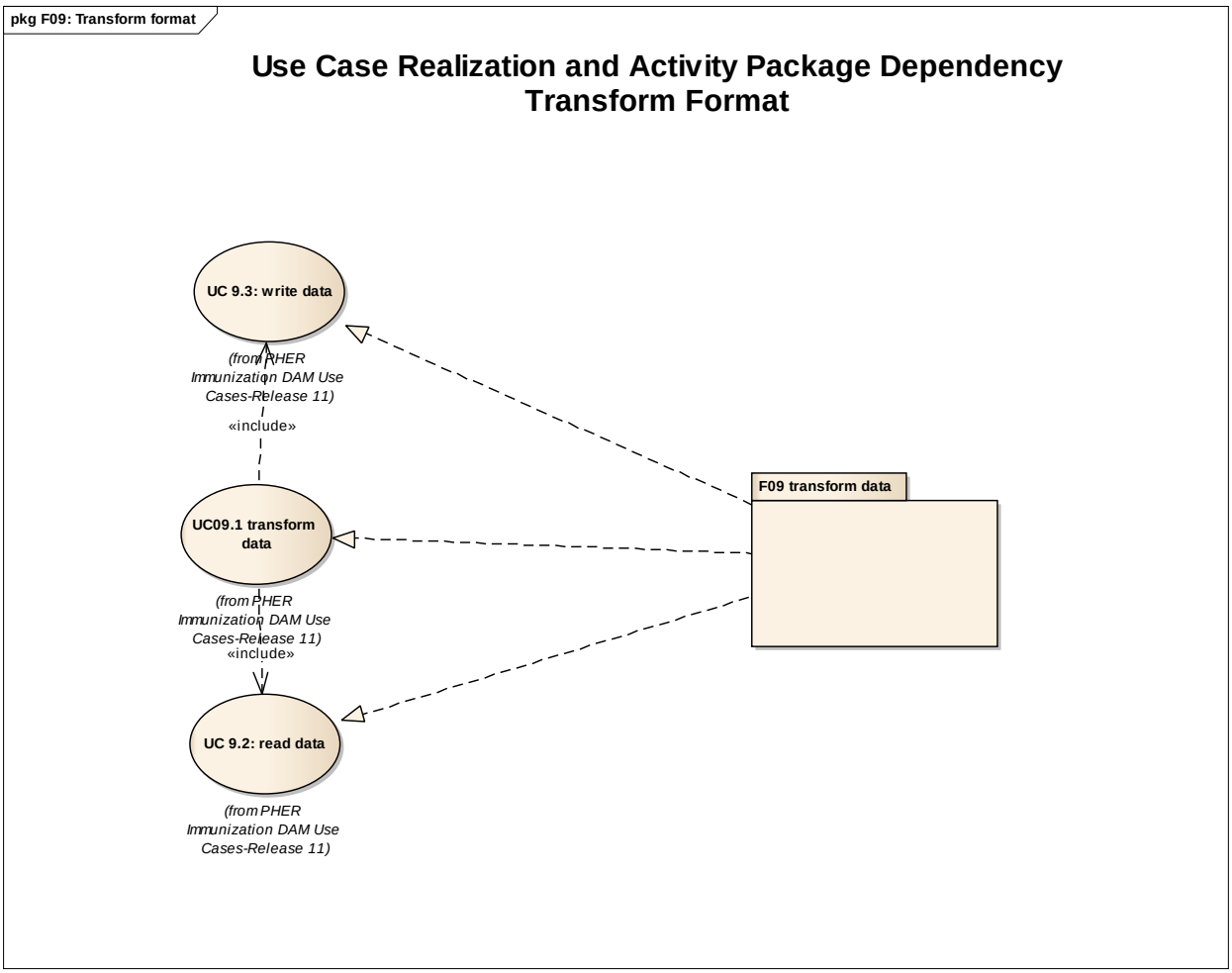

Figure: 9

F01.01: register identifiers (Activity Diagram)

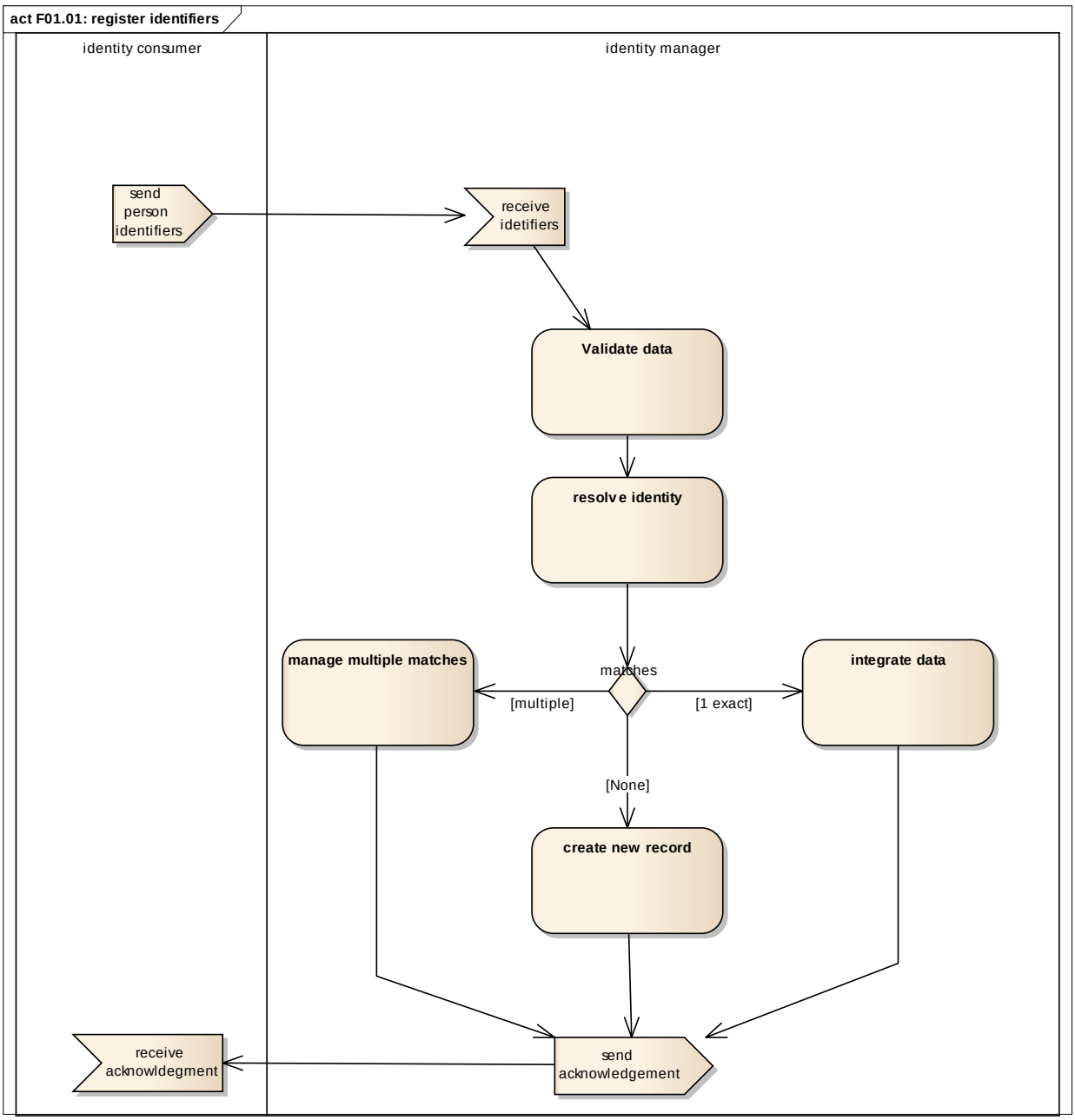

Figure: 10

Element Type	Element Name	Notes
Activity	Validate data	This activity applies local business rules to validate the data.
Activity	create new record	
Activity	integrate data	This activity follows local business rules to integrate the new information into existing person record.
Activity	manage multiple matches	This activity follows local procedures for handling multiple

		matches.
Activity	resolve identity	Determine if this person already exists in the identity registry.
Event	receive acknowldegment	
Event	receive idetifiers	The identity manager receives the identifiers and parses them for processing.
Event	send acknowledgement	Notify the system attempting to register person of outcome.
Event	send person identifiers	This activity sends the identifiers for a person.
DecisionNode	matches	Do we find an exact match, multiple matches or no match?

F01.02: request identifiers (Activity Diagram)

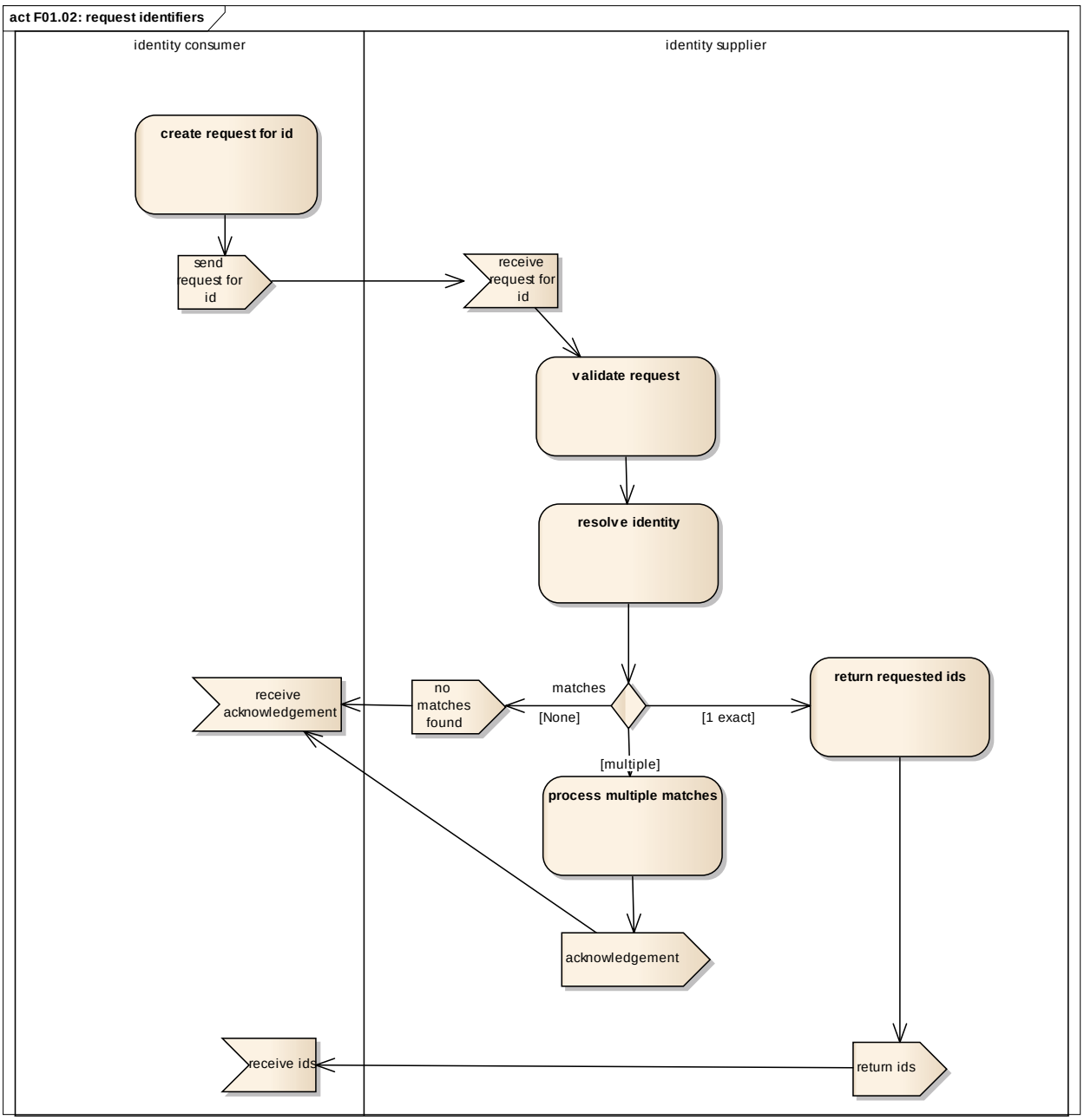

Figure: 11

Element Type	Element Name	Notes
Activity	create request for id	This activity builds the request for identifiers according to agreed profile.
Activity	process multiple matches	Follow local procedures for handling multiple matches.
Activity	resolve identity	This activity finds the person of interest.
Activity	return requested ids	This activity returns the requested ids for the person.
Activity	validate request	This activity validates the request

		against local business rules.
Event	acknowledgement	send acknowledgement of outcome
Event	no matches found	return acknowledgement that no matches have been found.
Event	receive acknowledgement	
Event	receive ids	
Event	receive request for id	This activity accepts the request and parses it.
Event	return ids	
Event	send request for id	
DecisionNode	matches	

F01.03 cross reference identifiers (Activity Diagram)

This activity is a specialization of the register and request identifiers. It maintains a cross reference of identifiers. It returns an identifier for one system when another system requests an identifier for the first system. The request is based on the second system identifier being cross mapped to the first system identifier.

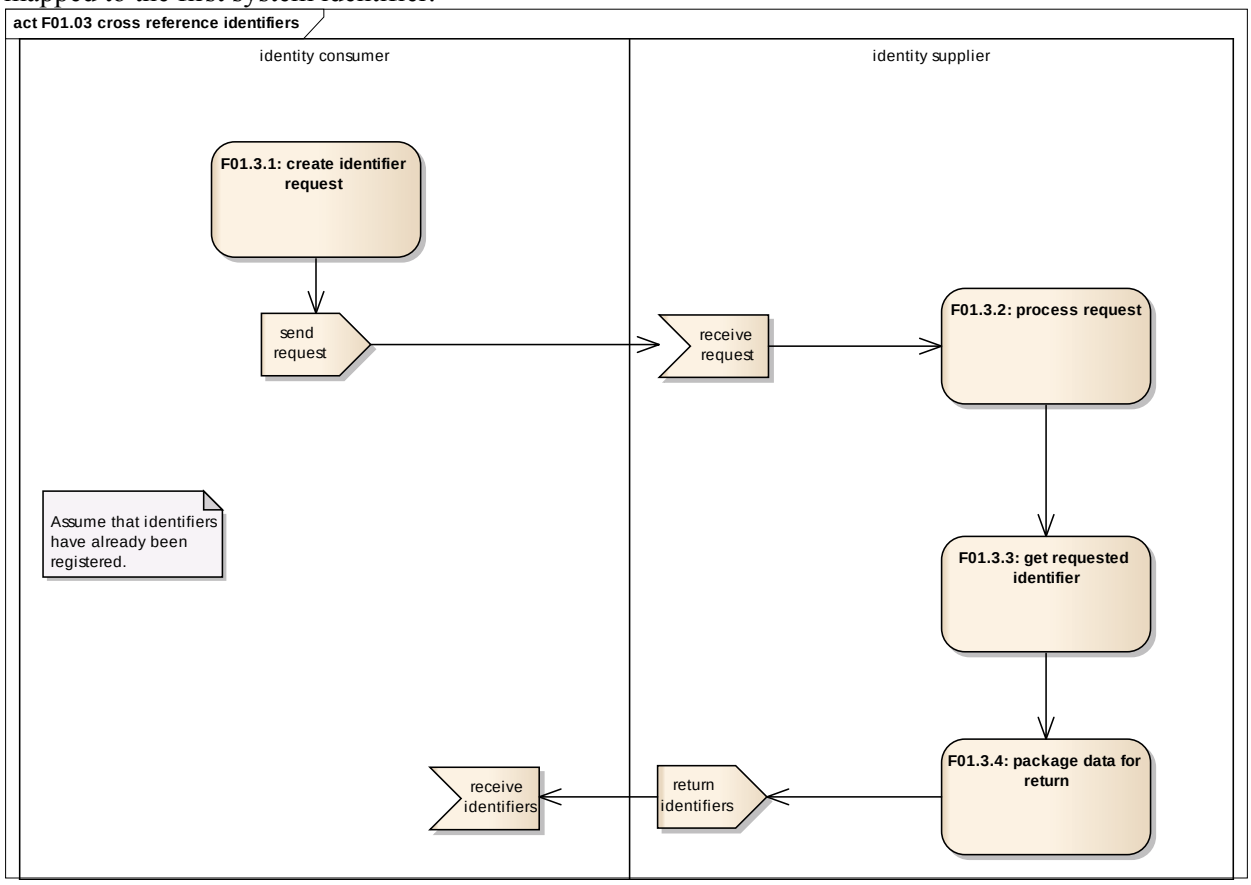

Figure: 12

Element Type	Element Name	Notes
Activity	F01.3.1: create identifier request	This request includes the identity consumer system identifier. Identity consumer system

		identifies the system who owns the identifier being requested.
Activity	F01.3.2: process request	This activity applies local business rules.
Activity	F01.3.3: get requested identifier	This activity finds the requested identifier of the system identified in the request.
Activity	F01.3.4: package data for return	
Event	receive identifiers	
Event	receive request	This event accepts the request and parses it into native format.
Event	return identifiers	
Event	send request	This event includes packaging the request into the appropriate format.

F01.04 record patient demographics (Activity Diagram)

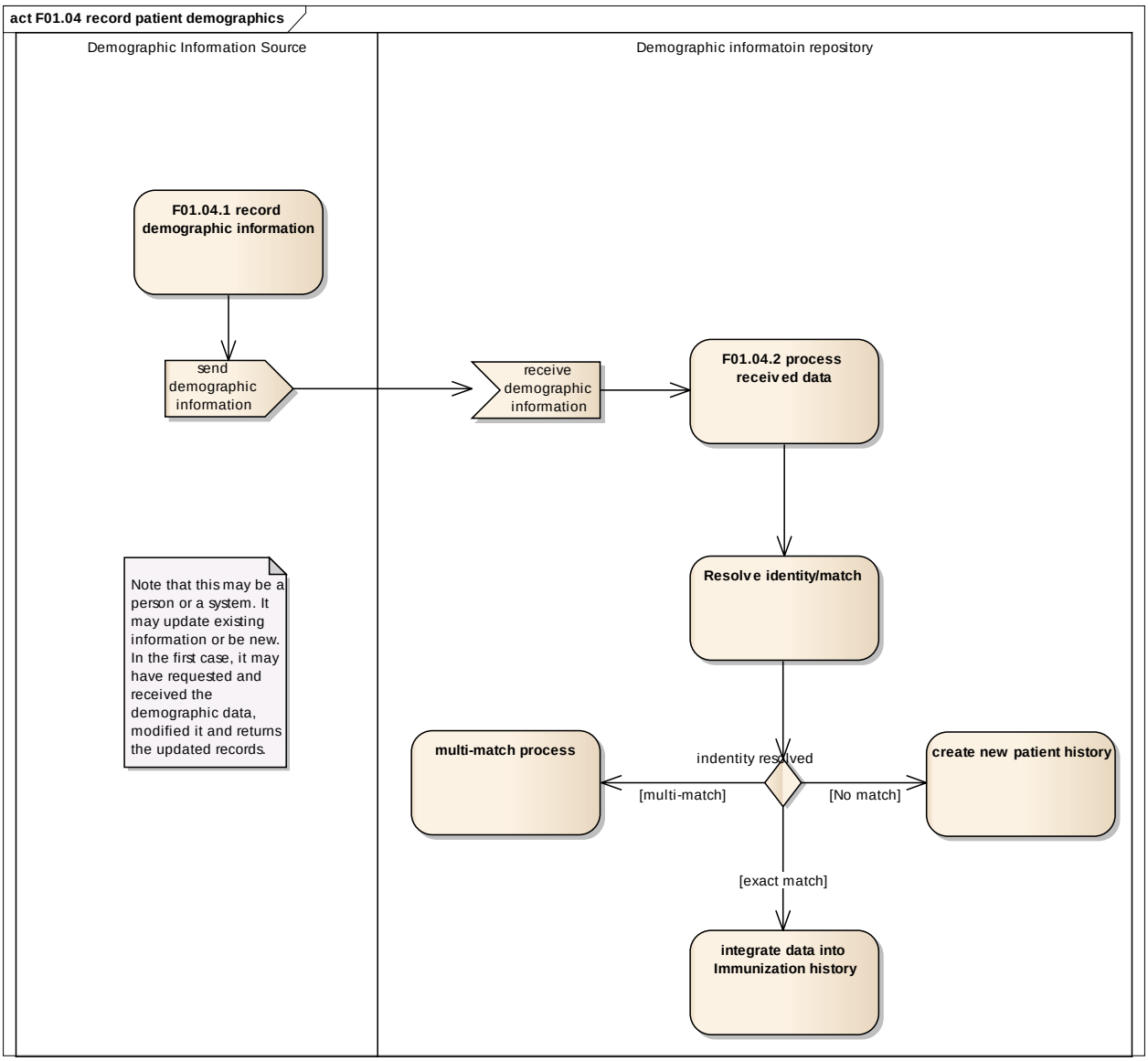

Figure: 13

Element Type	Element Name	Notes
Activity	F01.04.1 record demographic information	This activity may create new information or update existing information.
Activity	F01.04.2 process received data	This activity applies local business rules.
Activity	process multiple matches	Follow local procedures for handling multiple matches.
Activity	resolve identity	This activity finds the person of interest.
Activity	return requested ids	This activity returns the requested ids for the person.
Activity	validate request	This activity validates the request against local business rules.

Event	acknowledgement	send acknowledgement of outcome
Event	no matches found	return acknowledgement that no matches have been found.
Event	receive acknowledgement	
Event	receive demographic information	This activity accepts the incoming artifact and parses it into native format.
Event	receive ids	
Event	receive request for id	This activity accepts the request and parses it.
Event	return ids	
Event	send demographic information	This activity formats the pertinent data into the correct artifact and sends to the receiving system.
Event	send request for id	
DecisionNode	matches	

F01.05: request patient demographics (Activity Diagram)

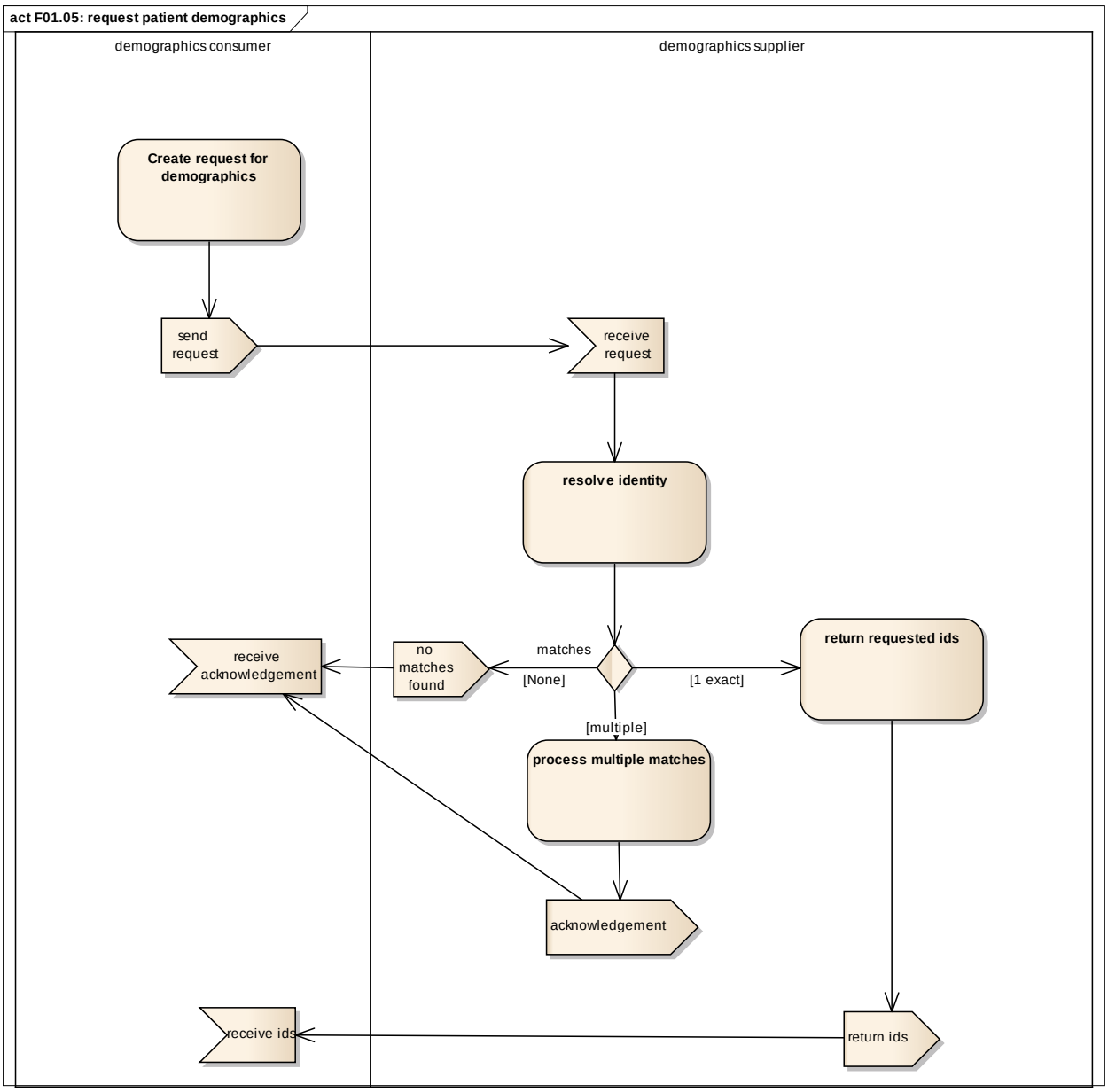

Figure: 14

Element Type	Element Name	Notes
Activity	Create request for demographics	This activity may call on an identity management service to cross reference ids. It will include the required request parameters expected by the demographics supplier.
Event	receive request	This event parses the incoming request.
Event	send request	

F02.01 Record immunization history (Activity Diagram)

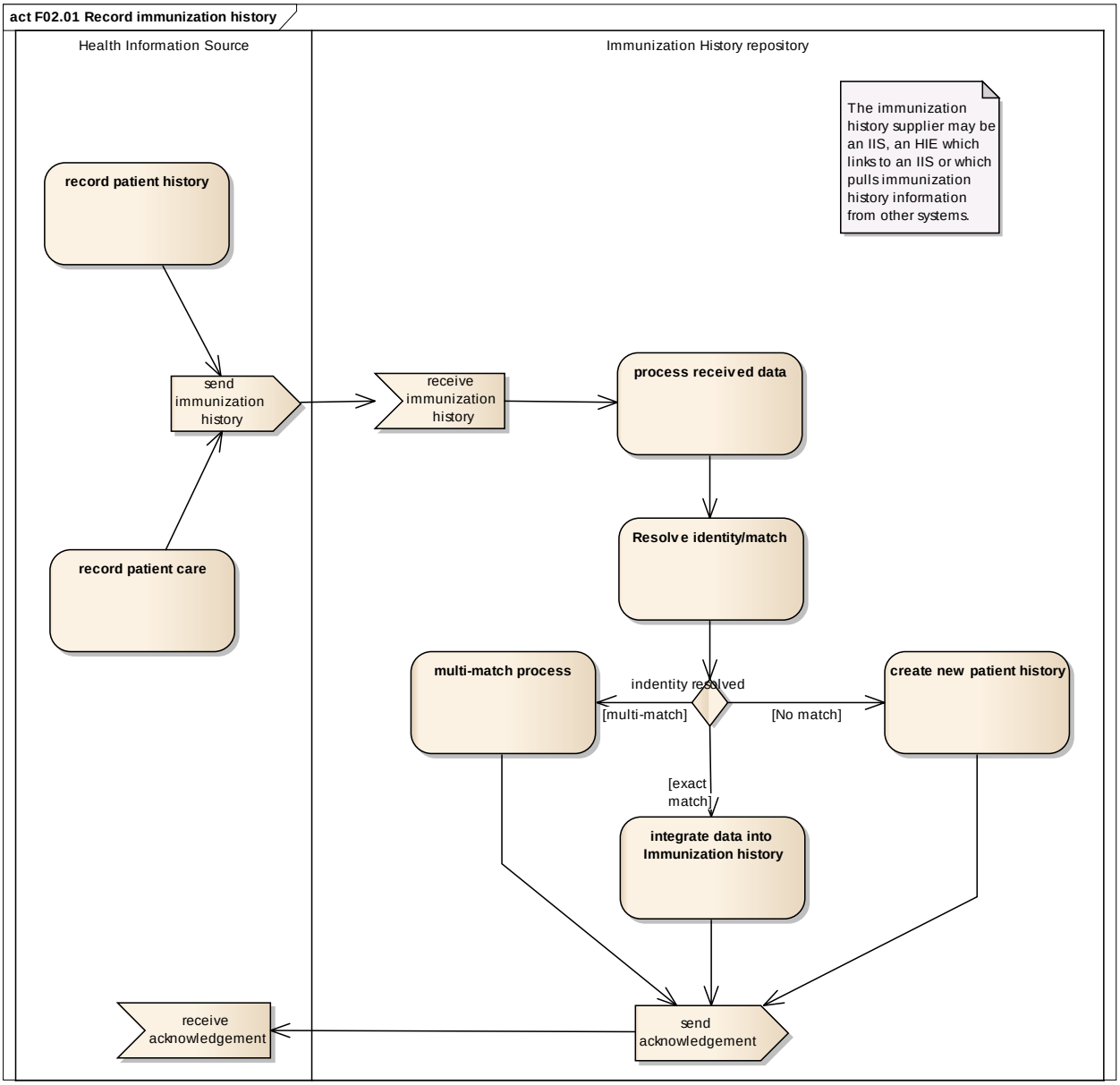

Figure: 15

Element Type	Element Name	Notes
Activity	Resolve identity/match	This activity determines if the incoming data belongs to an existing person in the immunization history supplier.
Activity	create new patient history	
Activity	integrate data into Immunization history	This activity integrates the incoming data into existing immunization history. This includes deduplicating

		immunization records.
Activity	multi-match process	Systems will have processes for dealing with matching more than one existing person.
Activity	process received data	This activity validates the received data and processes local business rules.
Activity	record patient care	This activity records current patient care activities, such as immunization in the health information system.
Activity	record patient history	This activity records patient health information from historical sources and patient report in the health information system, such as an EHR.
Event	receive acknowledgement	
Event	receive immunization history	This activity receives immunization history information from health information system. This includes authenticating and parsing the received data.
Event	send acknowledgement	
Event	send immunization history	This activity extracts pertinent data from the health information system and sends to the immunization history supplier. This information may be all immunization related information known to the sender or only the most current updates to the immunization history.
DecisionNode	indentity resolved	

F02.02 Request immunization history/ Return immunization history (Activity Diagram)

This activity shows both the request and return of immunization history.

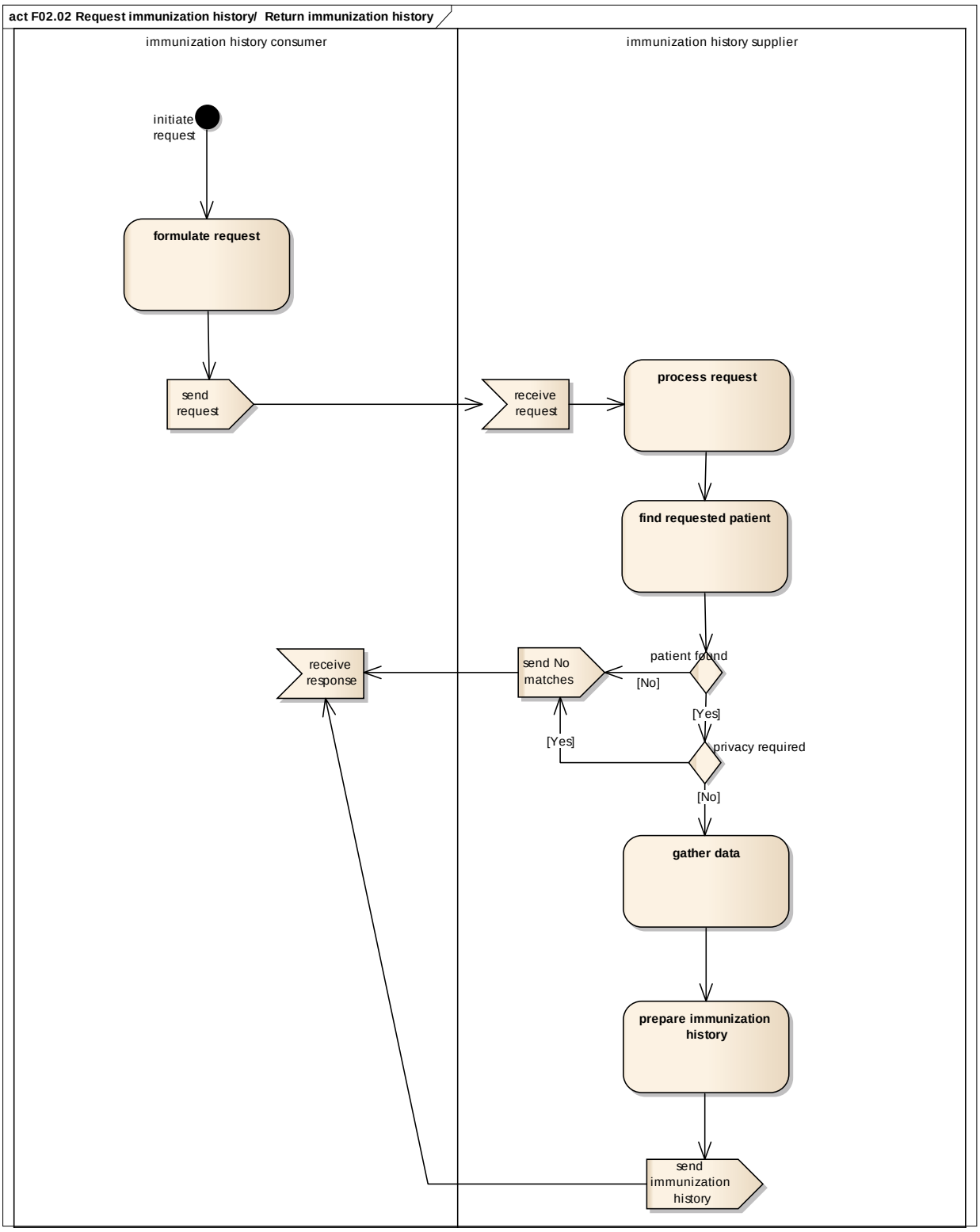

Figure: 16

Element Type	Element Name	Notes
Activity	find requested patient	This process finds the requested patient. It may do identity

		resolution internally or request from an external source.
Activity	formulate request	This activity formulates the request for a specific patient's immunization history. It may include a call to an identity resolution service, such as a Master Person Index.
Activity	gather data	This activity gathers the relevant data for the patient. It may rely on an HIE to pull data from a number of sources.
Activity	prepare immunization history	This activity prepares the immunization history for return to the requester. It is packaged into a message or document.
Activity	process request	This activity processes local business rules.
Event	receive request	This activity accepts the request and includes authentication and parsing of the request.
Event	receive response	
Event	send No matches	
Event	send immunization history	
Event	send request	This activity sends the requesting query to the immunization history supplier.
ActivityInitial	initiate request	Some actor asks for an immunization history.
DecisionNode	patient found	
DecisionNode	privacy required	If the person does not allow sharing of health information, then the immunization history supplier may not return an immunization history.

F02.03 Receive immunization history (Activity Diagram)

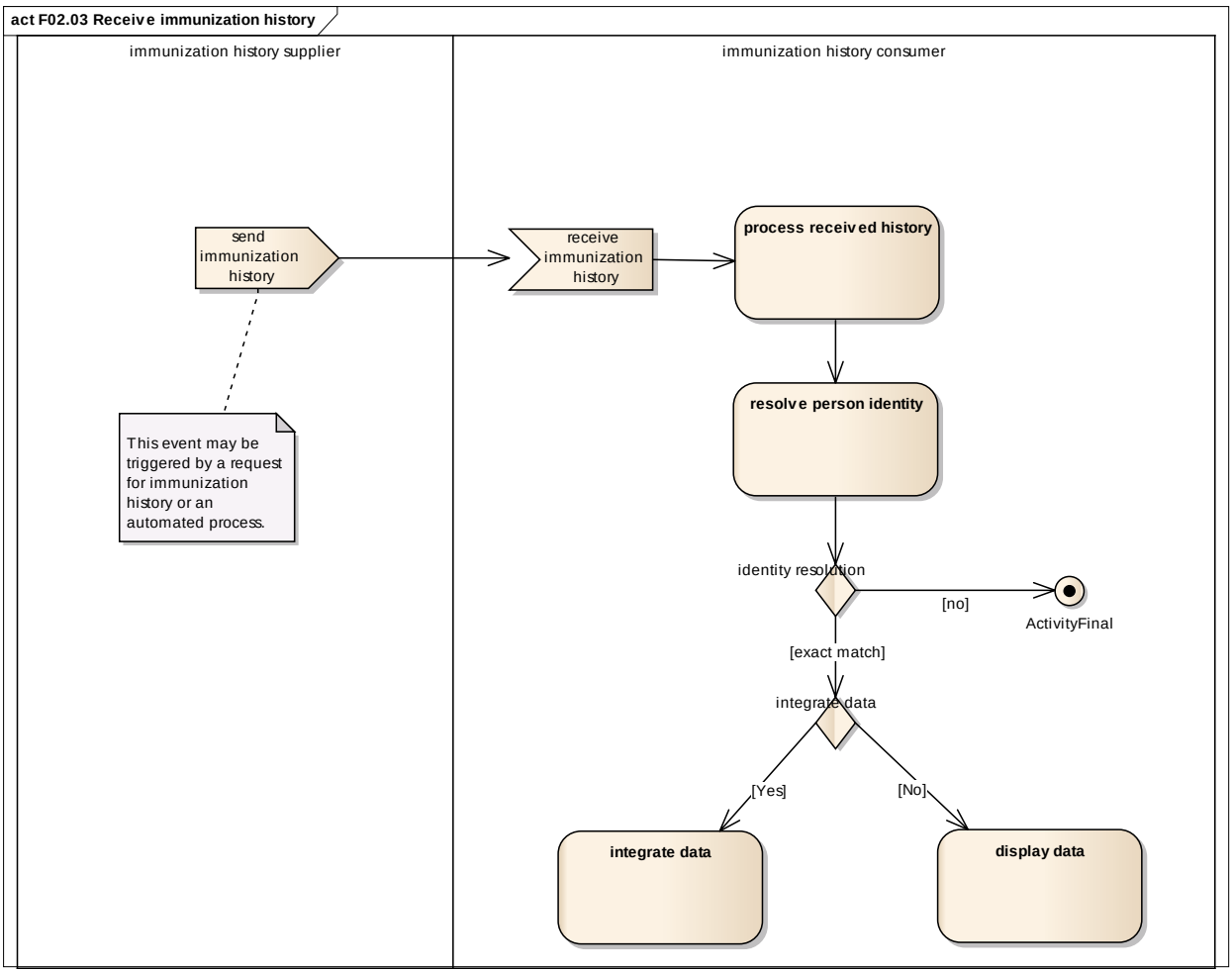

Figure: 17

Element Type	Element Name	Notes
Activity	display data	
Activity	integrate data	This is a multifaceted process which follows local business rules to deduplicate immunization events and integrate into any existing history.ln the case where the received data is a document, the data may be harvested or the document may be stored intact.
Activity	process received history	This activity applies local business rules and validates the data.
Activity	resolve person identity	This activity determines if the person is the one of interest. In an automated this is determined by business rules. It may call on external resources such as an MPI.
Event	receive immunization history	This event accepts an

		immunization history. It authenticates and parses the data.
Event	send immunization history	This activity follows a set of activities which gather and package the information.
ActivityFinal	ActivityFinal	
DecisionNode	identity resolution	This resolution may be automated or may involve human review. For example, if a clinician working on an EHR may request immunization records for a given patient. He/she may review the returned history and determine it is not for the patient of interest.
DecisionNode	integrate data	Some systems may only display the data, while others may incorporate it into local data stores.

F03 Manage CDS (Activity Diagram)

This activity gathers the relevant data, identifies the appropriate rule set and parameter. It includes this in a request to a CDS supplier. Note that the actual architecture may vary. It then generates the evaluation and forecast and returns to the requester.

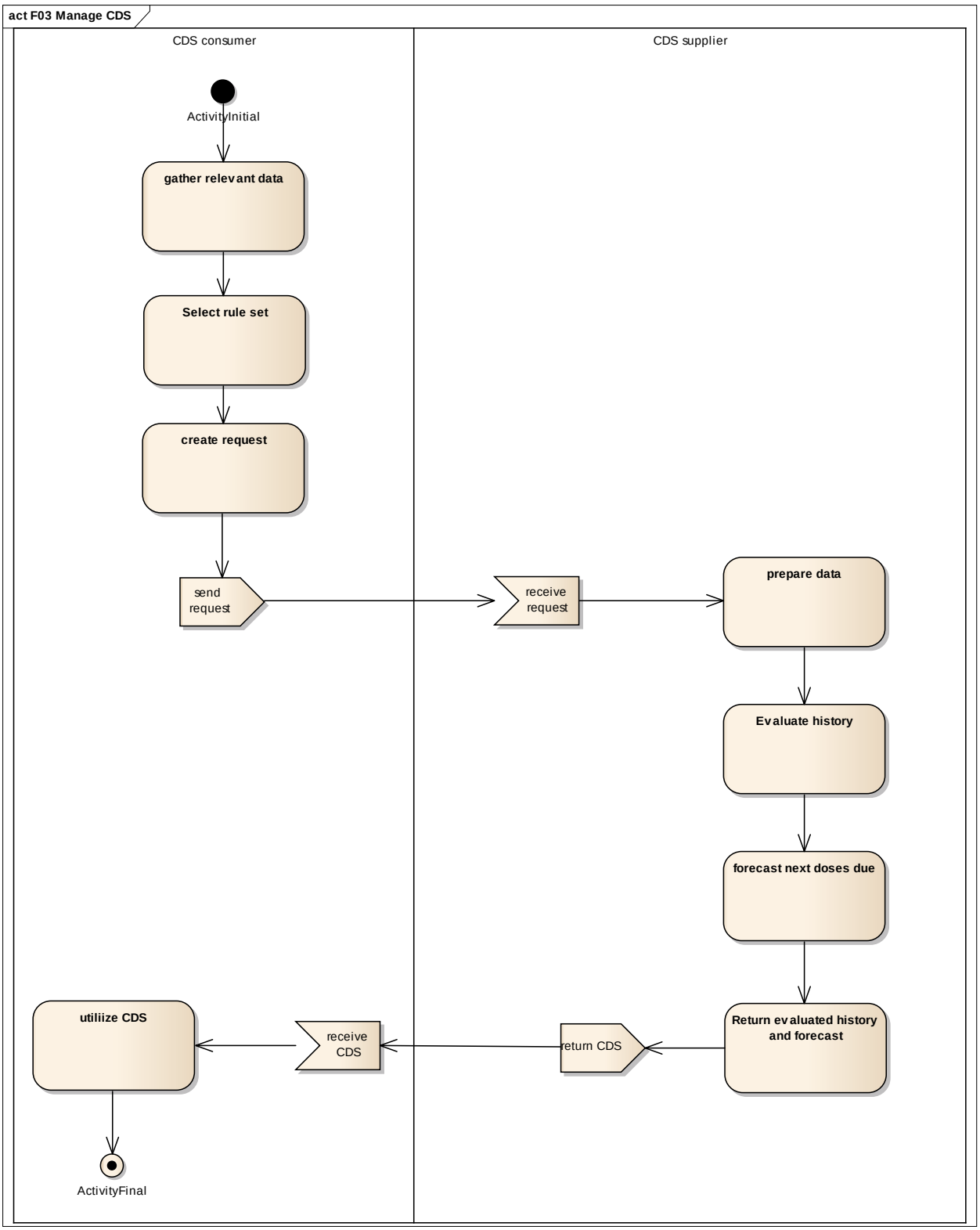

Figure: 18

Element Type	Element Name	Notes
Activity	Evaluate history	This activity evaluates the

		immunization history of the person and determines whether the doses received are appropriately given. It also identifies the specific series that will be used for the forecasting step.
Activity	Return evaluated history and forecast	This activity packages the results from the evaluation and the forecast and returns to the requester.
Activity	Select rule set	This activity identifies the schedule (rule set and supporting parameters) that will be used by the CDS. Note that the CDS may support only one schedule.
Activity	create request	This activity packages the data and forwards it to the CDS provider.
Activity	forecast next doses due	This activity applies the relevant rules and parameters to a forecast of next doses due.
Activity	gather relevant data	Gather the relevant immunization history data, including patient conditions.
Activity	prepare data	this step organizes the immunization history into a useful configuration in preparation for processing.
Activity	utiliize CDS	This activity may incorporate into the display of the consumer system. It may also make other use of the information, like supporting creation of reminder reports.
Event	receive CDS	
Event	receive request	
Event	return CDS	
Event	send request	
ActivityFinal	ActivityFinal	
ActivityInitial	ActivityInitial	

F04: Manage Adverse Event Reporting (Activity Diagram)

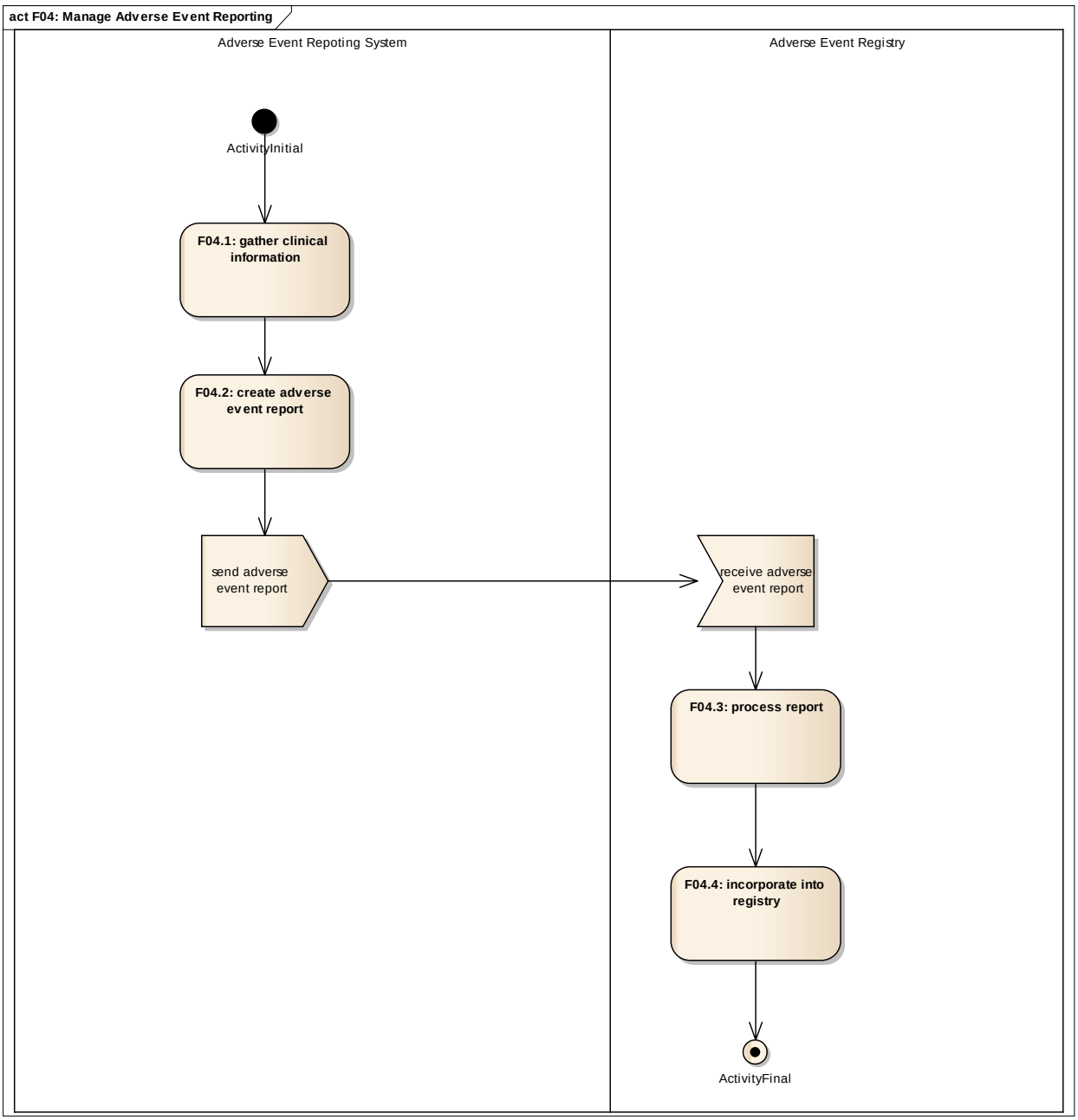

Figure: 19

Element Type	Element Name	Notes
Activity	F04.1: gather clinical information	This activity gathers information from patient report, clinical records and immunization history. It may require receipt of this data from various sources.
Activity	F04.2: create adverse event report	This activity composes the report into the prescribed format.
Activity	F04.3: process report	This activity applies local business rules and prepares the report for incorporation of the

		data into the registry.
Activity	F04.4: incorporate into registry	
Event	receive adverse event report	
Event	send adverse event report	
ActivityFinal	ActivityFinal	
ActivityInitial	ActivityInitial	The trigger for adverse event reporting may come from patient report, clinician report or other source.

F05.4: Manage Vaccine Inventory (Activity Diagram)

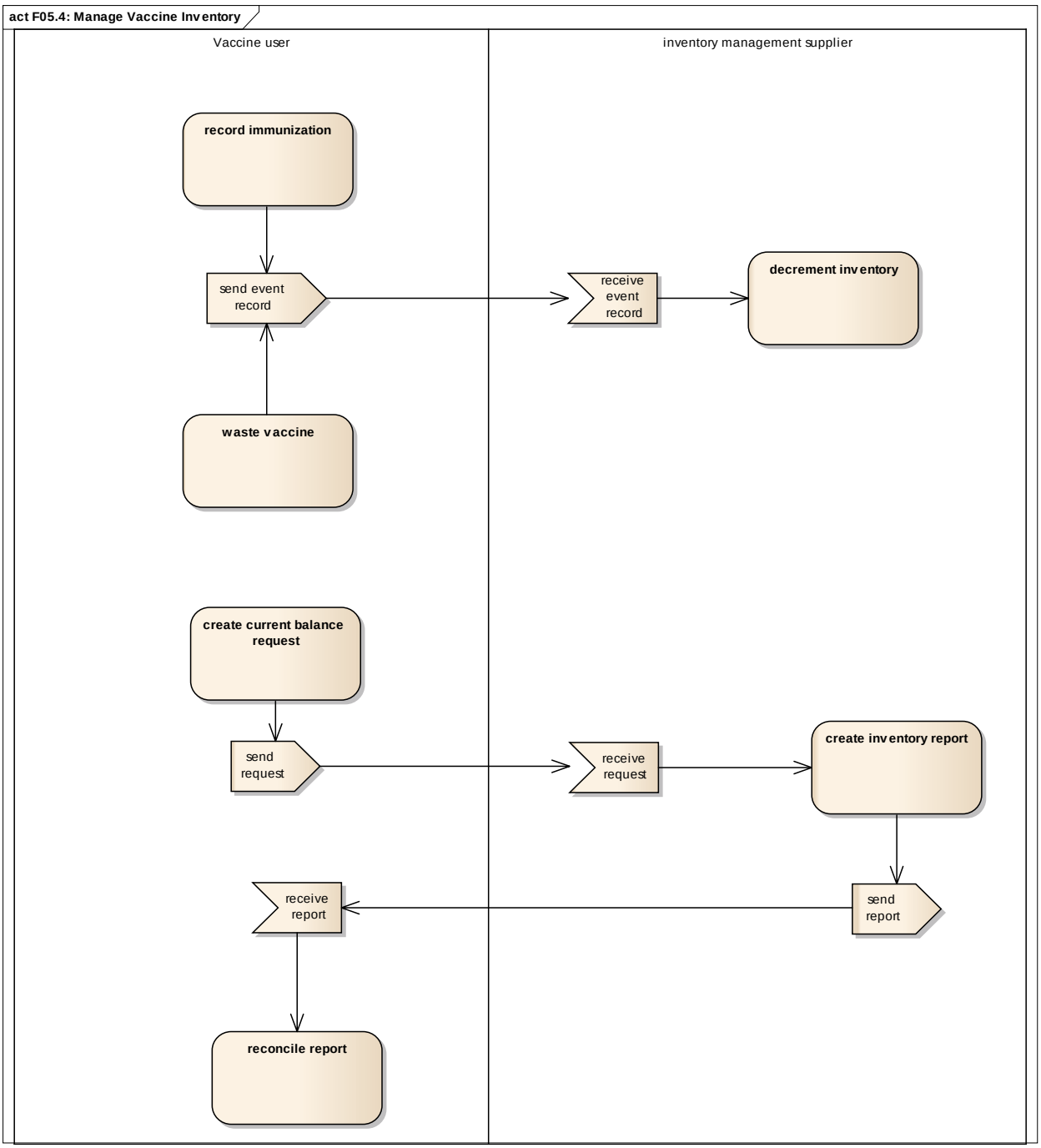

Figure: 20

Element Type	Element Name	Notes
Activity	create current balance request	This activity creates a request for current balance on one or more vaccines.
Activity	create inventory report	This activity creates the report on current inventory for the requester and specified vaccines.
Activity	decrement inventory	This activity decrements the

		vaccine inventory.
Activity	reconcile report	This activity compares the reported vaccine inventory with physical inventory.
Activity	record immunization	This activity records the immunization event in the vaccine user information system.
Activity	waste vaccine	This activity records vaccine wastage.
Event	receive event record	
Event	receive report	
Event	receive request	
Event	send event record	
Event	send report	
Event	send request	

F05.4.1 order vaccine (Activity Diagram)

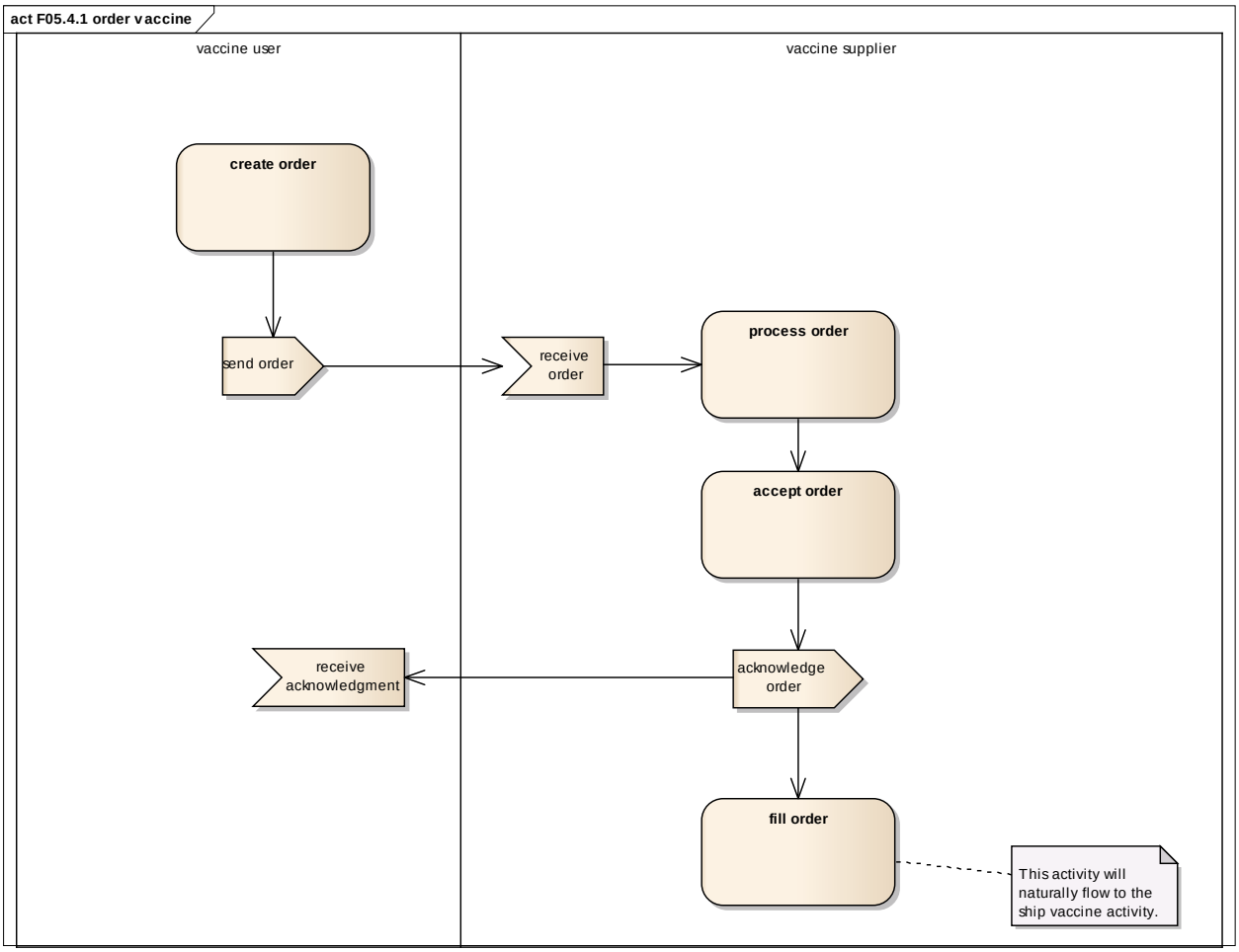

Figure: 21

Element Type	Element Name	Notes

Activity	accept order	This activity determines that the order will be filled. It may approve the whole order, reject the whole order or approve parts of the order. Inventory on hand and business rules will drive this decision. It records the order in the vaccine supplier system.
Activity	create order	This activity creates an order for vaccines.
Activity	fill order	This activity packages the requested vaccines in preparation for shipping them.
Activity	process order	This activity applies local business rules.
Event	acknowledge order	This activity informs the requesting system of the status of the order.
Event	receive acknowledgment	This event receives the acknowledgment. The requester will be aware of the status of all requested items.
Event	receive order	This activity receives the order from the vaccine user and parses it.
Event	send order	This event formats the order for sending and sends it to the distributor.

F05.4.2 receive vaccine & F05.4.3 ship vaccine (Activity Diagram)

This activity illustrates the activities involved in shipping and receiving vaccines. These activities may be chained to order vaccine and support reconcile vaccine inventory.

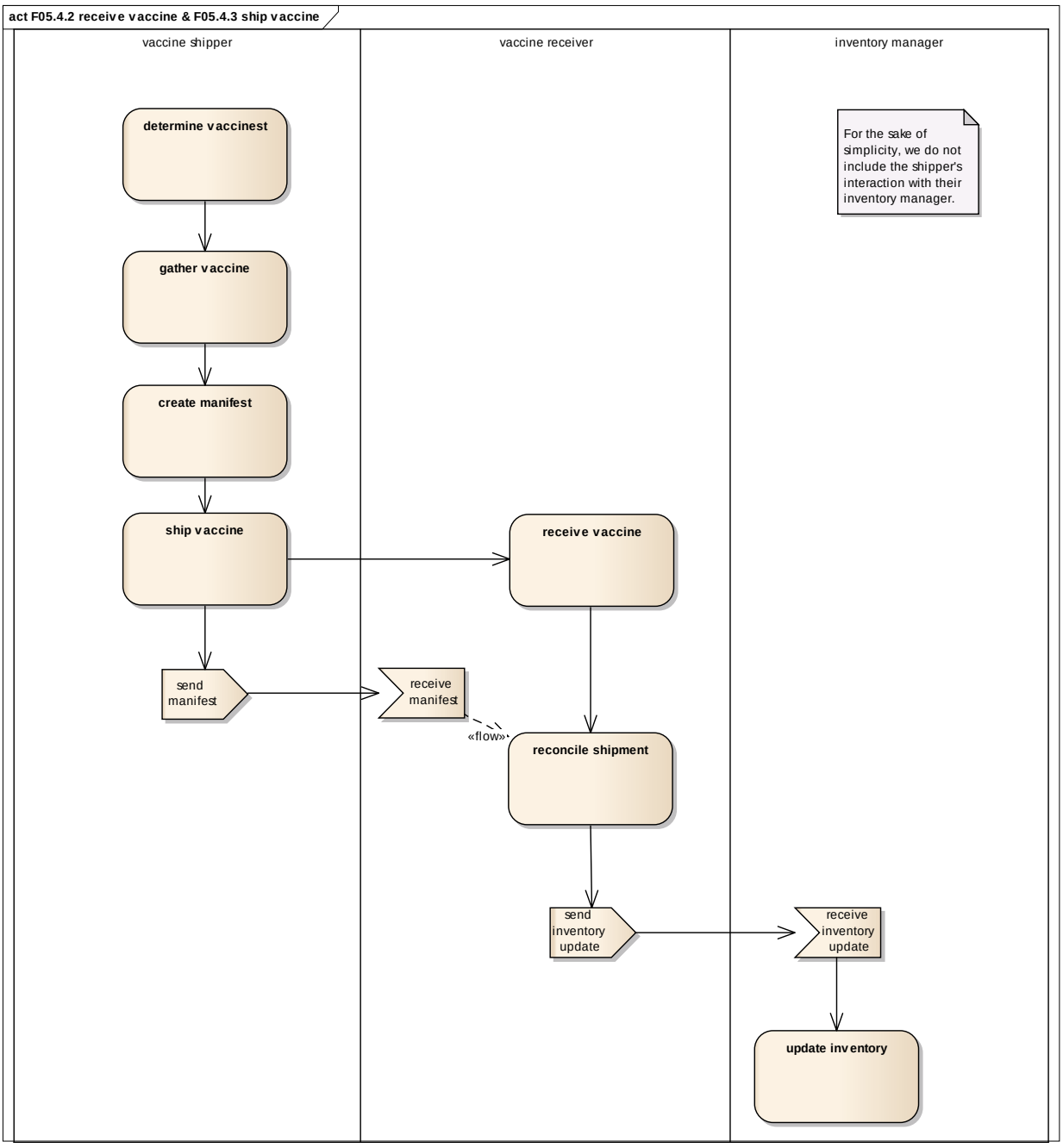

Figure: 22

Element Type	Element Name	Notes
Activity	create manifest	This activity documents the vaccines being shipped.
Activity	determine vaccinest	This activity list of vaccines being shipped. It may be in response to an order.
Activity	gather vaccine	This activity gathers and packages the vaccines for shipment.

Activity	receive vaccine	This activity receives the physical vaccine shipment.
Activity	reconcile shipment	This activity reconciles the shipment with the manifest. It also determines any vaccines that are unacceptable due to damage.
Activity	ship vaccine	This activity ships the physical vaccine.
Activity	update inventory	This activity updates the inventory records, adding the new vaccines to the inventory.
Event	receive inventory update	
Event	receive manifest	
Event	send inventory update	
Event	send manifest	

F06: Clinical Care (Activity Diagram)

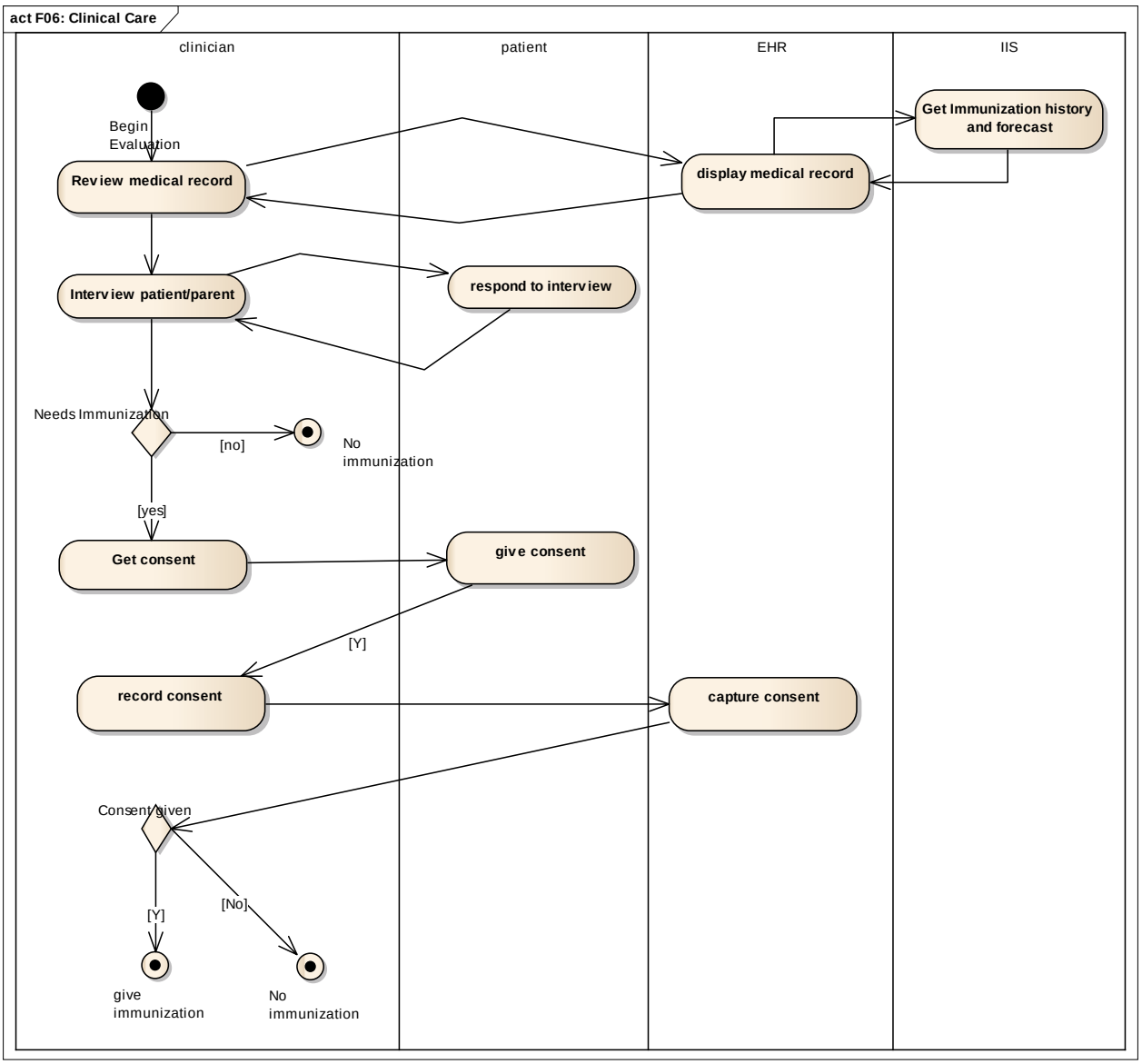

Figure: 23

Element Type	Element Name	Notes
Activity	Get Immunization history and forecast	
Activity	Get consent	
Activity	Interview patient/parent	
Activity	Review medical record	
Activity	administer vaccine	This is the act of giving the patient the immunization.
Activity	capture consent	
Activity	display medical record	
Activity	give consent	
Activity	record consent	
Activity	respond to interview	
ActivityFinal	ActivityFinal	

ActivityInitial	ActivityInitial	
ActivityInitial	Begin Evaluation	The goal of this activity is to determine the immunization needs of a patient.
DecisionNode	Consent given	
DecisionNode	Needs Immunization	
ActivityFinal	No immunization	
ActivityFinal	No immunization	
ActivityFinal	give immunization	

F07: Request report (Activity Diagram)

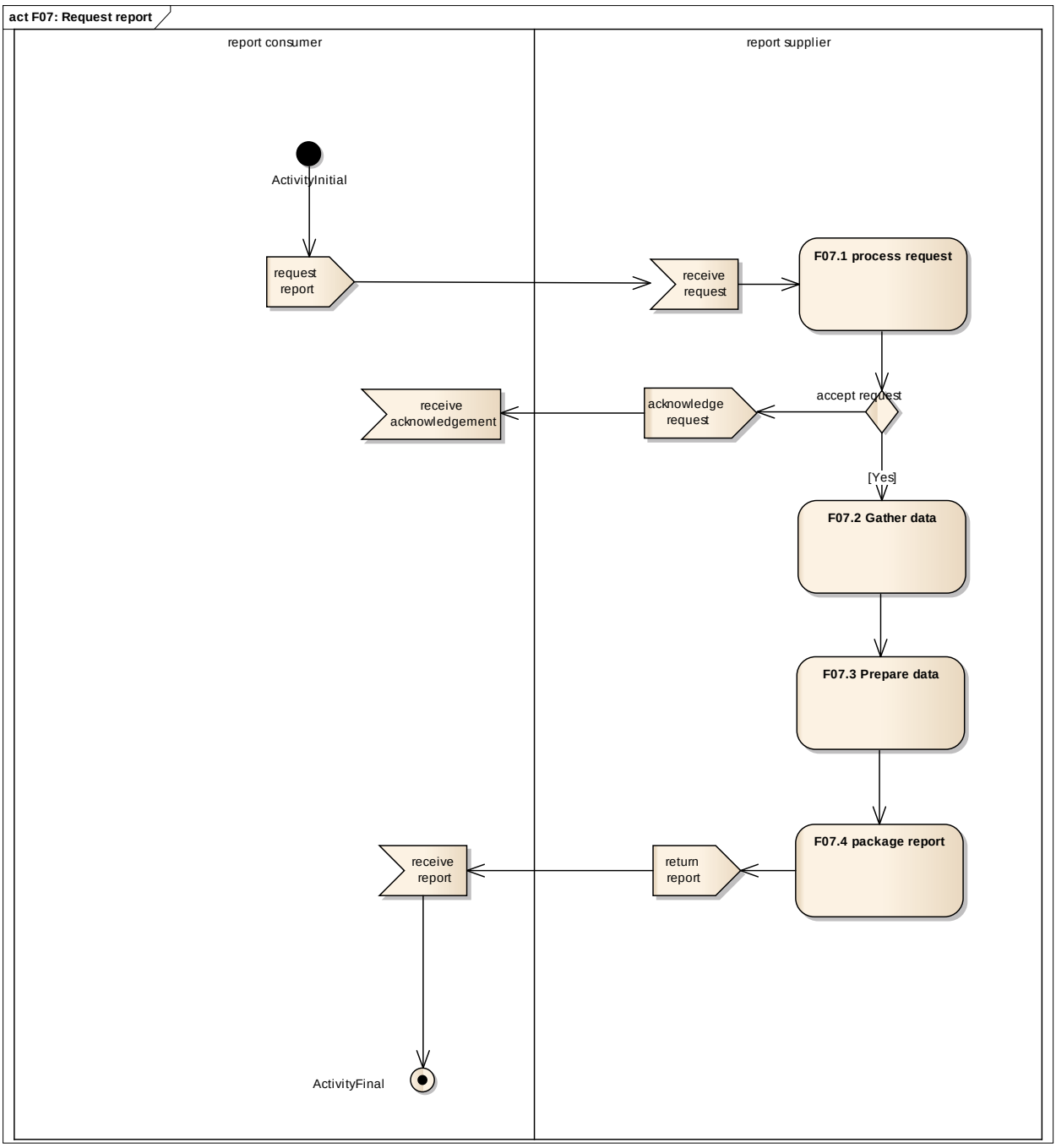

Figure: 24

Element Type	Element Name	Notes
Activity	F07.1 process request	This activity applies local business rules to request.
Activity	F07.2 Gather data	This activity gathers the relevant data to be used in the report. This data may come from more than one data supplier.
Activity	F07.3 Prepare data	This activity prepares the data for the report. This may include

		calculations, sorting and filtering.
Activity	F07.4 package report	Package the report for return to requestor.
Event	acknowledge request	The event reports request rejection.
Event	receive acknowledgement	
Event	receive report	
Event	receive request	
Event	request report	
Event	return report	
ActivityFinal	ActivityFinal	
ActivityInitial	ActivityInitial	The parameters of interest are known.
DecisionNode	accept request	supplier accepts request for report

F07.5 Create Reminder Report (Activity Diagram)

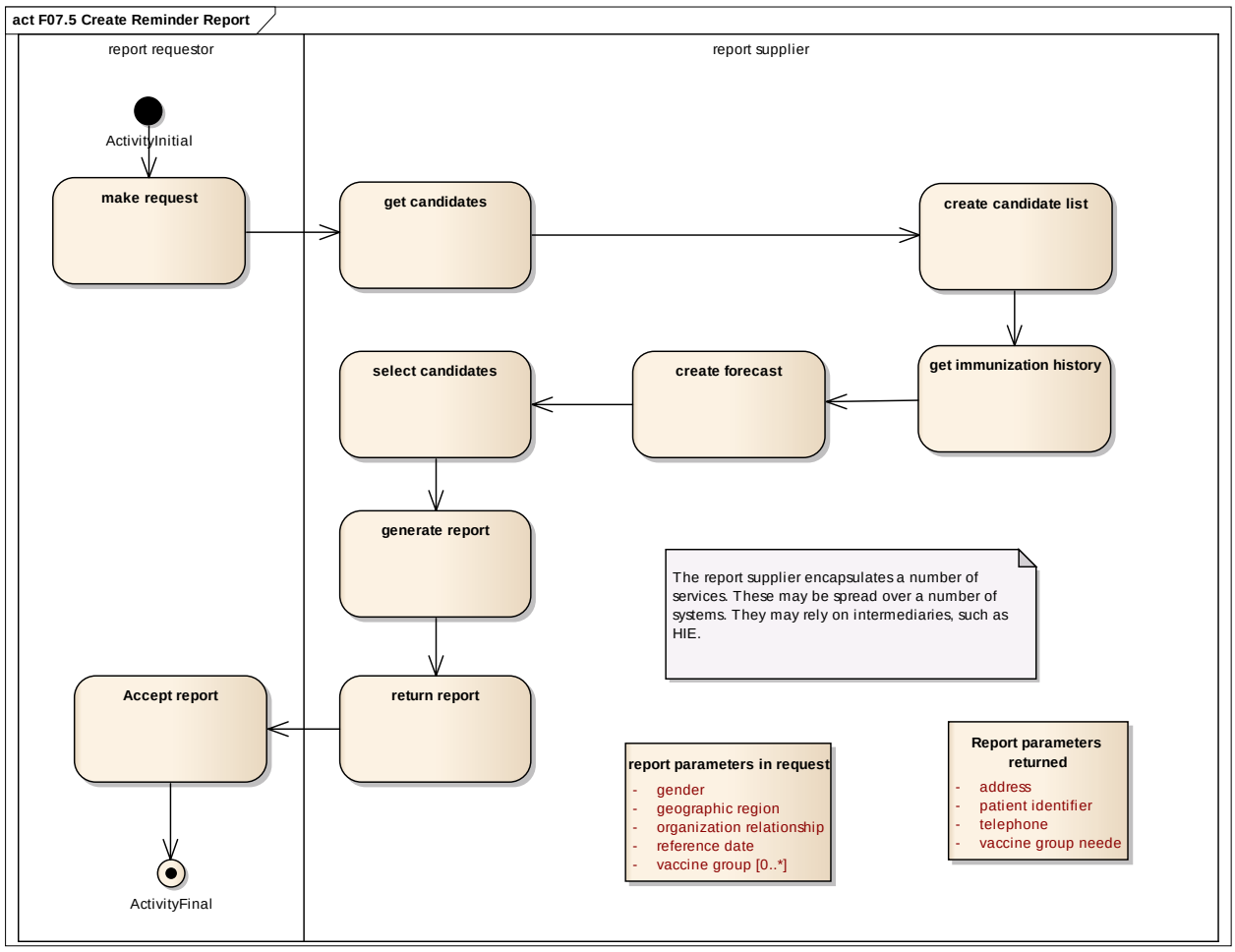

Figure: 25

Element Type	Element Name	Notes
Object	Report parameters returned	This is a list of typical parameters

		returned by this report request.
Object	report parameters in request	
Activity	Accept report	
Activity	create candidate list	This activity returns a list of people who may need to have an immunization.
Activity	create forecast	This activity creates a forecast for each candidate. If a vaccine group is specified, it only returns that forecast.
Activity	generate report	This activity generates the report in the format requested. This may be an electronic report to support automated calls or post cards to be sent to patients.
Activity	get candidates	This activity gets a list of people meeting the input parameters of age, geography, etc. This list will supply candidates who need CDS.
Activity	get immunization history	This activity gets the immunization history, including patient conditions for each candidate.
Activity	make request	The requestor indicates who (age, location, school, etc), the reference date and the list of vaccine groups of interest.
Activity	return report	This activity returns the requested report to the requestor.
Activity	select candidates	This activity selects those patients who need immunization in the time frame specified.
ActivityFinal	ActivityFinal	
ActivityInitial	ActivityInitial	

F07.6 Create vaccine usage report (Activity Diagram)

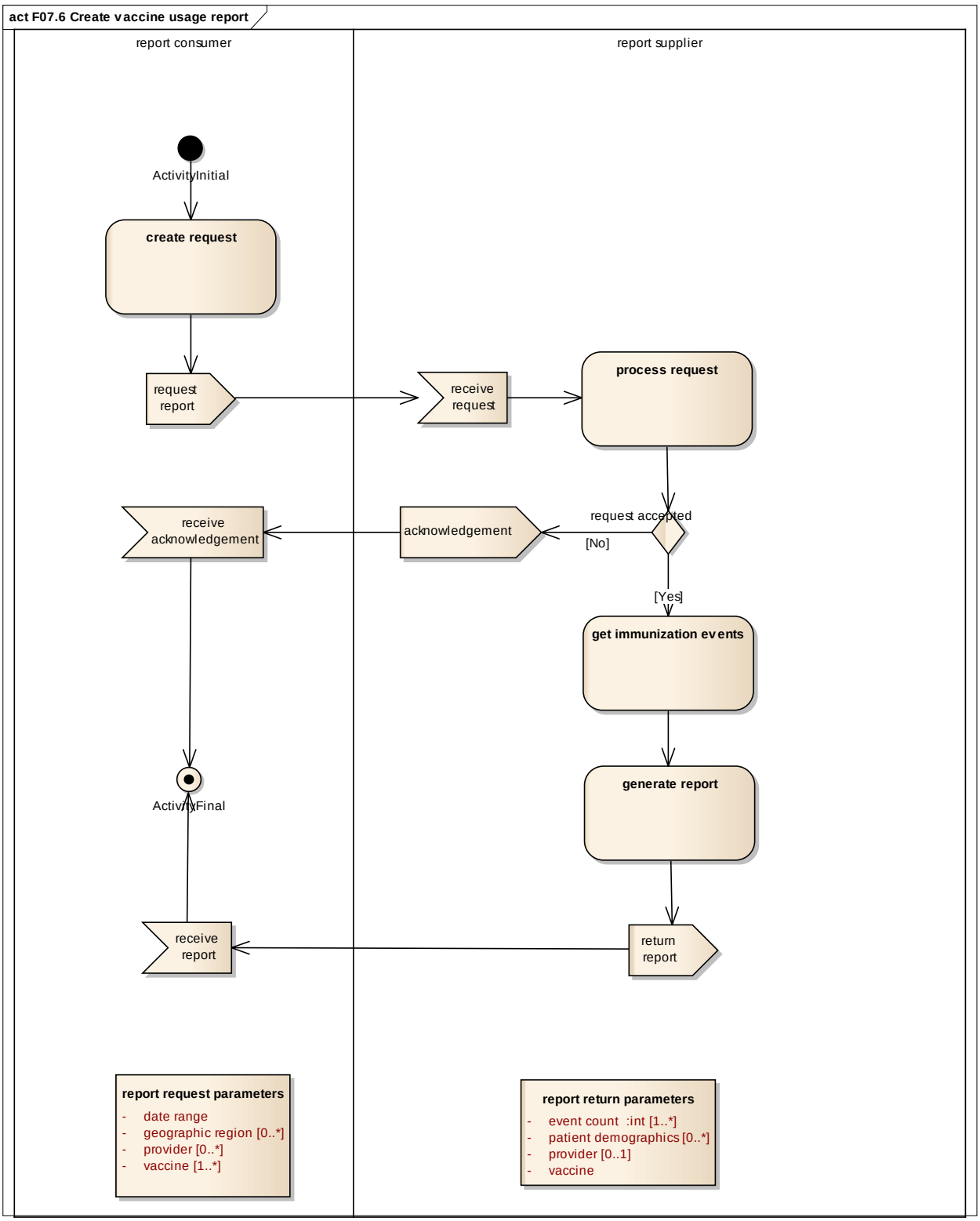

Figure: 26

Element Type	Element Name	Notes
Object	report request parameters	
Object	report return parameters	

Activity	create request	This activity prepares the request for a vaccine usage report. It indicates the time frame of interest, the vaccines of interest and any other parameters to control the report.
Activity	generate report	
Activity	get immunization events	Get immunization events of interest.
Activity	process request	This activity process local business rules.
Event	acknowledgement	reject request
Event	receive acknowledgement	
Event	receive report	
Event	receive request	This activity parses the request.
Event	request report	
Event	return report	
ActivityFinal	ActivityFinal	
ActivityInitial	ActivityInitial	
DecisionNode	request accepted	

F07.7 Create vaccine coverage report (Activity Diagram)

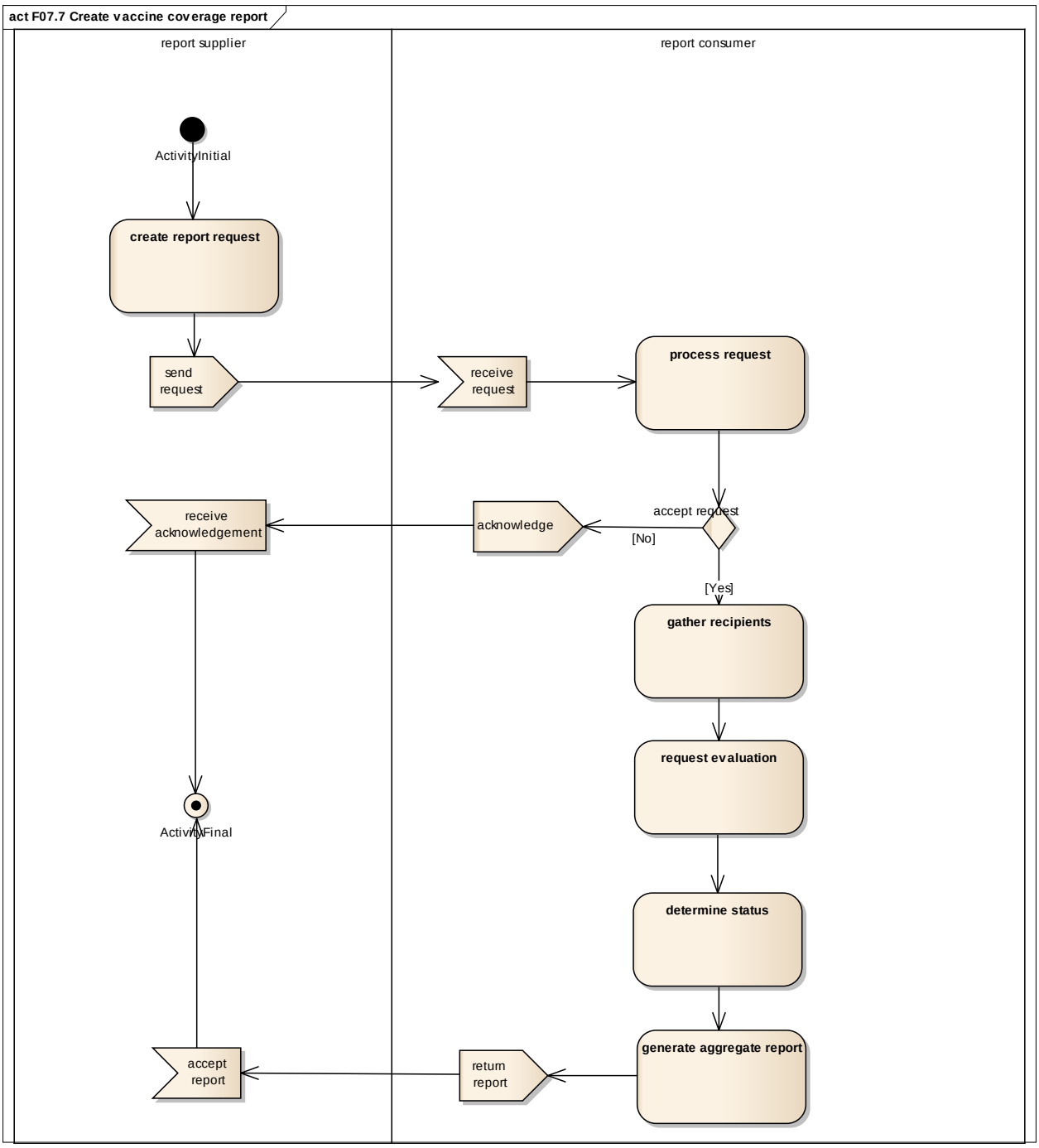

Figure: 27

Element Type	Element Name	Notes
Activity	create report request	
Activity	determine status	Determine status for each target disease of interest for each recipient.
Activity	gather recipients	Gather the recipients of interest.
Activity	generate aggregate report	
Activity	process request	This activity processes local

		business rules.
Activity	request evaluation	Request immunization history evaluation for selected patients.
Event	accept report	
Event	acknowledge	Acknowledge request rejection.
Event	receive acknowledgement	
Event	receive request	this event parses the request
Event	return report	
Event	send request	
ActivityFinal	ActivityFinal	
ActivityInitial	ActivityInitial	
DecisionNode	accept request	

Manage CDS Rules (Eriksson-Penker Diagram)

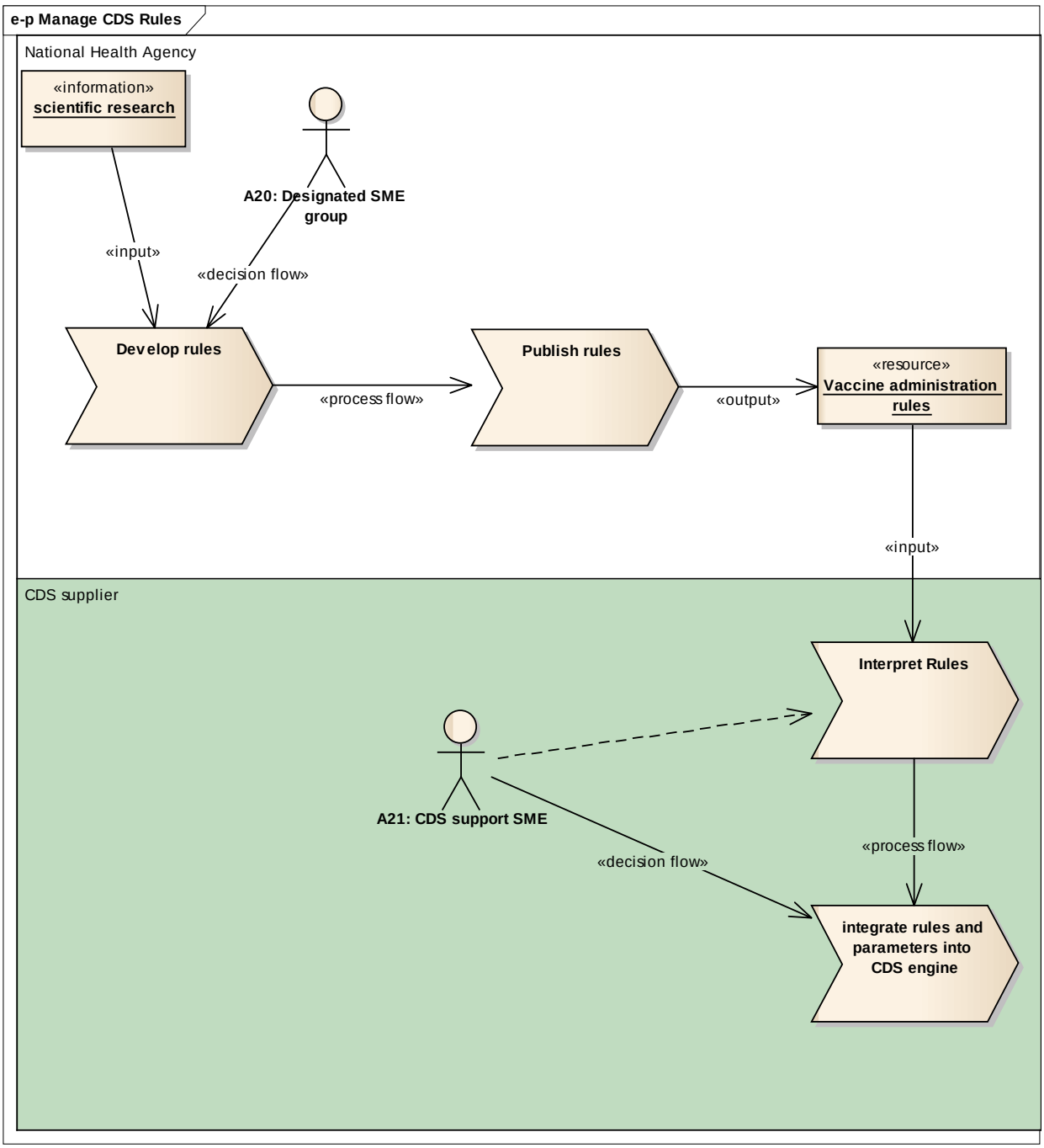

Figure: 28

Element Type	Element Name	Notes
Resource	Vaccine administration rules	
Information	scientific research	published scientific research regarding immunology and safety
Process	Develop rules	SME consider scientific research and clinical practice to define the rules and supporting parameters. The goals of these are to

		maximize the likelihood that a recipient will be immune to an infectious disease.
Process	Interpret Rules	
Process	Publish rules	Publish the rules and supporting parameters.
Process	integrate rules and parameters into CDS engine	

F09 transform data format (Activity Diagram)

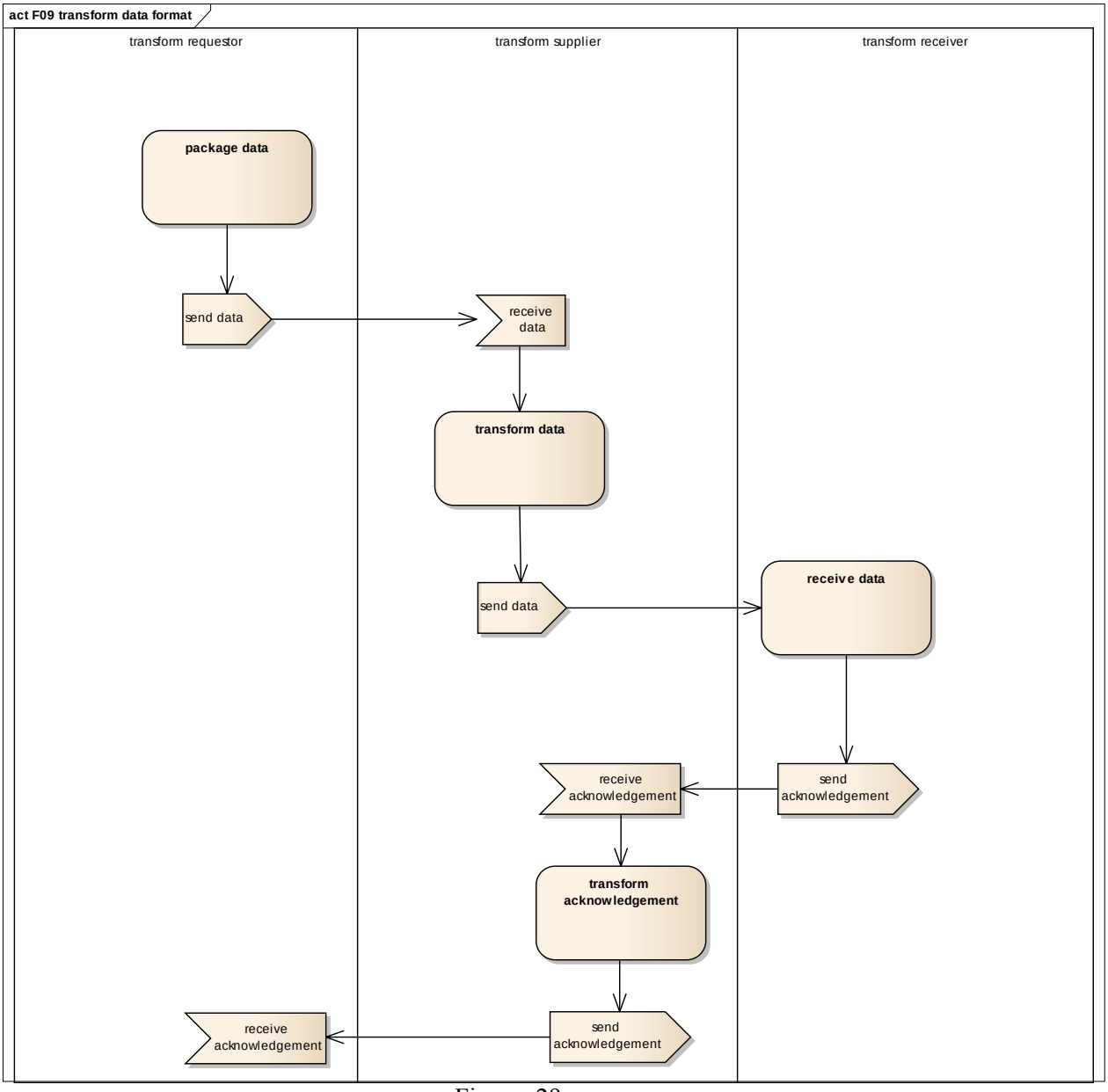

Figure: 29

Element Type	Element Name	Notes
Activity	package data	This activity packages data in a specified format.
Activity	receive data	
Activity	transform acknowledgement	
Activity	transform data	This activity transforms the data to the desired format.
Event	receive acknowledgement	
Event	receive acknowledgement	
Event	receive data	This event receives the data and parses it. It may apply business rules.
Event	send acknowledgement	
Event	send acknowledgement	
Event	send data	
Event	send data	This event sends the packaged data and requests transformation. It also indicates a data receiver.