

## The building blocks of public health

Prototyping data ingestion pipelines out of modular FHIR-based microservices



HL7 FHIR DevDays 2023 | Hybrid Edition, Amsterdam | June 6–9, 2023 | @HL7 | @FirelyTeam | #fhirdevdays | [www.devdays.com](http://www.devdays.com)

ORGANIZED BY

**firely**

**HL7**  
International

## Who We Are



*Emma Stephenson*

Skylight 



*Brady Fausett*

Skylight 

# Data Integration Building Blocks



# Public Health in the United States

## Services Provided

- Screening for diseases and conditions
- Disease prevention through education
- Maintaining disease and immunization registries
- Public laboratory tests
- Data collection for epidemiologic activities and analysis
- Much more!

## Decentralized System

- State, local, territorial, and tribal entities
- Data received from a variety of senders



# The Problems

*Working with public health data is challenging!*

**Volume** – many messages

**Velocity** – new data arriving every day

**Variety** – many conditions, senders, and formats

**Veracity** – non-standard and potentially inaccurate

**Value** – low signal to noise ratio

**Variability** – incoming data and analytical needs change quickly



# Our Solution

Free, open-source modular Building Blocks that can be composed into data cleaning and refinement pipelines.



# Pilot Partners



**Los Angeles County, CA**

**State of Virginia**

# The Role of FHIR

## Building Blocks

Access the range of modular Building Blocks as containerized services, which can be imported out of the box to ingest and report on public health data. To see the full suite of containerized services, check out our [containers repository](#) and learn how to integrate them into your data system with our documentation below.

[Alerts BB](#)[FHIR Converter BB](#)[Ingestion BB](#)[Message Parser BB](#)[Record Linkage BB](#)[Tabulation BB](#)[Validation BB](#)



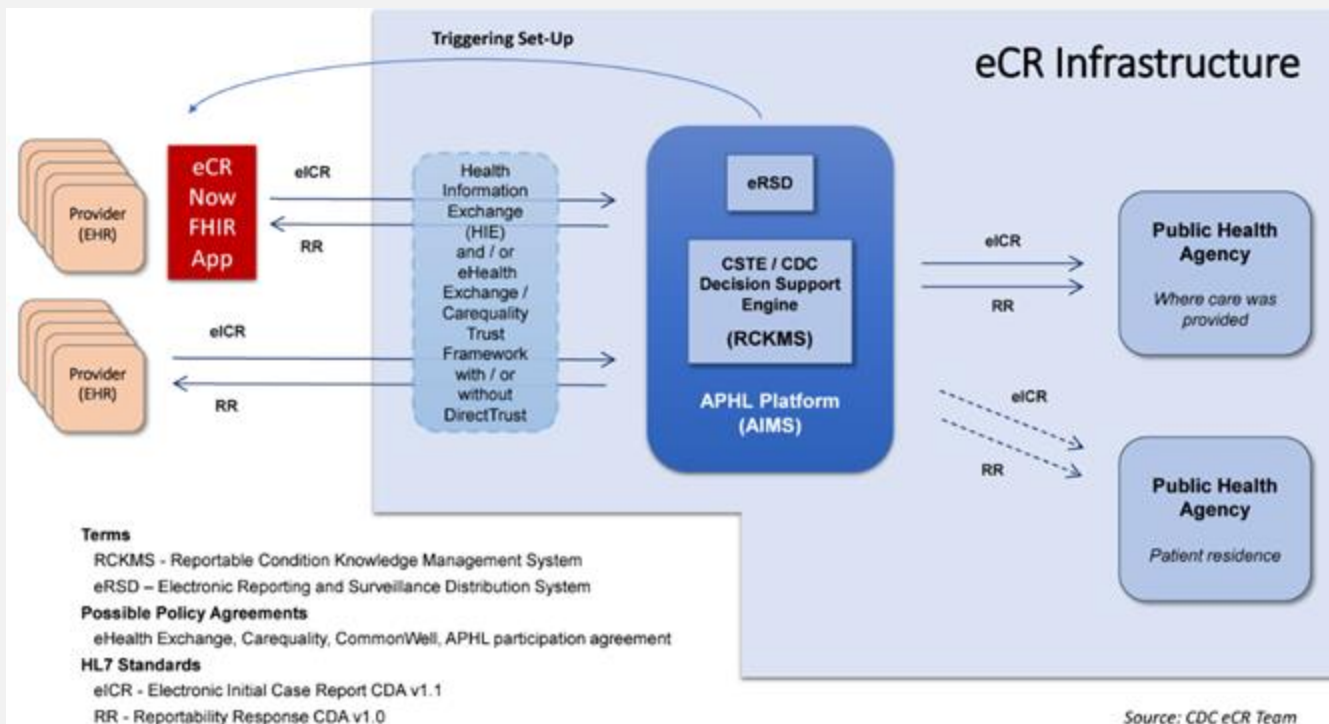
## What is this eCR thing?



*“Electronic case reporting (eCR) is the automated, real-time exchange of case report information between electronic health records (EHRs) and public health agencies.” – cdc.gov*

- **eCR** - Electronic Case Report
  - **eICR** - Initial Electronic Case Report
  - **RR** - Reportability Response
- **ELR** - Electronic Lab Record (HL7v2)

# eCR Flow



# eCR Messages - What's the problem?

*eCR Data is robust, but complicated...*

Highly Nested

Heavy

Not Human Readable

Variety of Standards

```
<observation... >
  <code code="loinc code"... >
```

VS.

```
<observation... >
  <code... >"loinc code"</code>
```

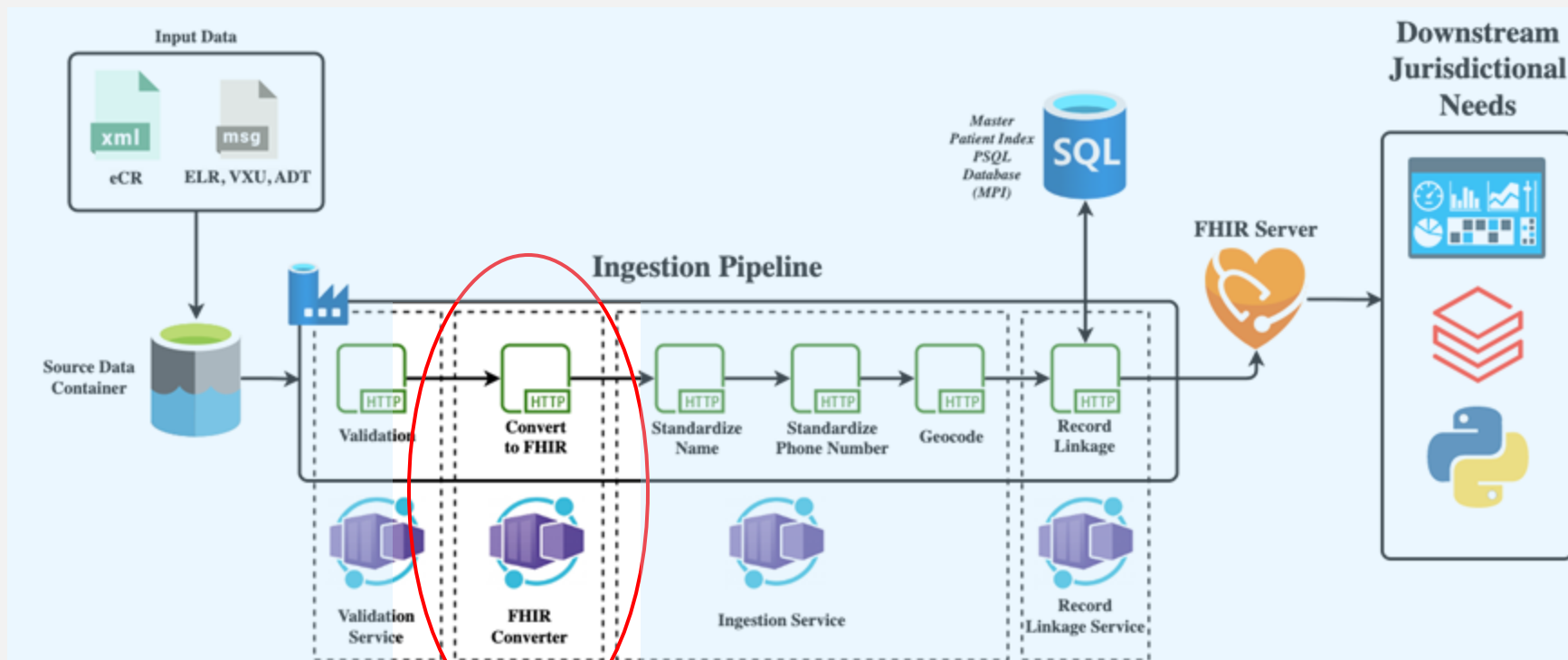
VS.

```
<observation... >
  <code...>
    <translation code="loinc code"... >
```

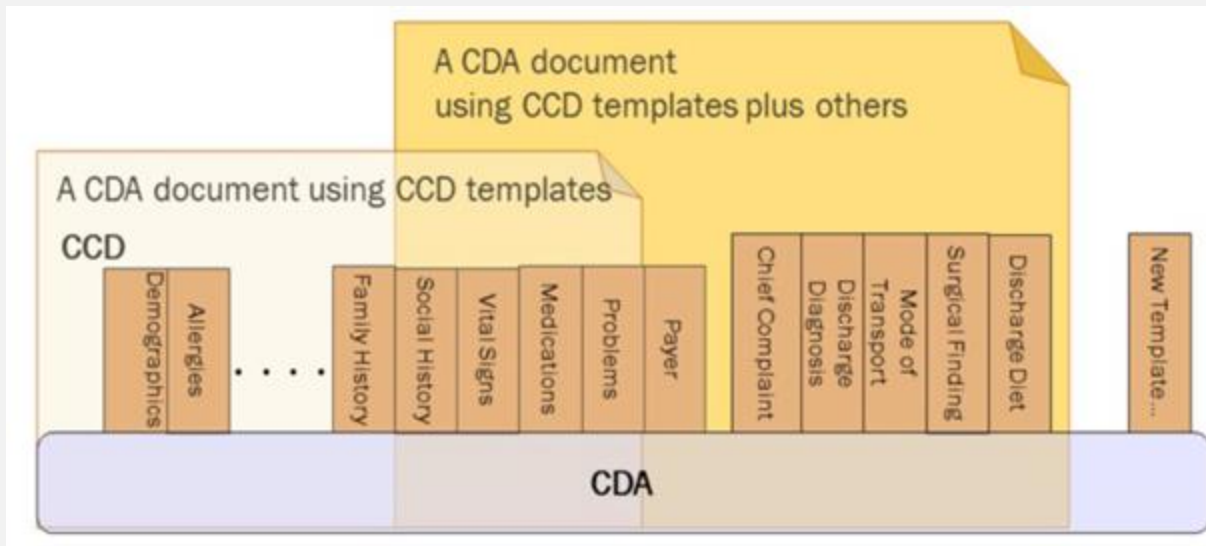
```

1083 <templateId root="2.16.840.1.113883.10.20.22.4.119"/>
1084 <templateId extension="2015-08-01" root="2.16.840.1.113883.10.20.22.5.4"/>
1085 <time value="2015-08-01T10:00:00-0400"/>
1086 <assignedAuthor>
1087 <!-- NPI of Author -->
1088 <id nullFlavor="UNK" root="2.16.840.1.113883.10.20.22.4.3"/>
1089 <assignedPerson>
1090 <name>
1091 <!-- Name of Assigned Person -->
1092 <!-- Name of Assigned Person -->
1093 </name>
1094 </name>
1095 </assignedPerson>
1096 <representedOrganization>
1097 <!-- Represented Organization -->
1098 <!-- Represented Organization -->
1099 </representedOrganization>
1100 </assignedAuthor>
1101 </author>
1102 </observation>
1103 </entryRelationship>
1104 </act>
1105 </entry>
1106 <entry typeCode="OBTN">
1107 <!-- Problem Concern Act (V3) [act: identifier urn:hl7ii:2.16.840.1.113883.10.20.22.4.3:2015-08-01 10g732 -->
1108 <act classCode="ACT" moodCode="EVN">
1109 <templateId extension="2015-08-01" root="2.16.840.1.113883.10.20.22.4.3"/>
1110 <templateId root="2.16.840.1.113883.10.20.22.4.3"/>
1111 <id root="2.16.840.1.113883.10.20.22.4.3"/>
1112 <code code="3026" codeSystem="2.16.840.1.113883.10.20.22.4.3" codeSystemName="HL7 ActClass" displayName="Concern"/>
1113 <!-- The statusCode represents the need to continue tracking the problem -->
1114 <!-- This is of ongoing concern to the provider -->
1115 <statusCode code="active"/>
1116 <!-- The low value represents when the problem was first recorded in the patient's chart -->
1117 <effectiveTime>
1118 <!-- Effective Time -->
1119 </effectiveTime>
1120 </entryRelationship typeCode="SUBJ">
1121 <!-- Problem observation (V3) observation: identifier urn:hl7ii:2.16.840.1.113883.10.20.22.4.4:2015-08-01 10g737 -->
1122 <observation classCode="OBS" moodCode="EVN" negationInd="false">
1123 <templateId extension="2015-08-01" root="2.16.840.1.113883.10.20.22.4.4"/>
1124 <templateId root="2.16.840.1.113883.10.20.22.4.4"/>
1125 <id root="2.16.840.1.113883.10.20.22.4.4"/>
1126 <code code="554870M" codeSystem="2.16.840.1.113883.8.66" codeSystemName="SNOMED-CT" displayName="Problem"/>
1127 </code>
1128 </observation>
1129 </entryRelationship typeCode="SUBJ">
1130 </entryRelationship typeCode="SUBJ">
1131 </entryRelationship typeCode="SUBJ">
    
```

# Solution - Convert XML to FHIR



# eCR Source Data - CDA (XML) Composition



Source: [http://www.hl7.org/implement/standards/product\\_brief.cfm?product\\_id=436](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=436)











# DIBBs FHIR Converter

▼ FHIR-CONVERTER

▼ Templates


▼ Ccda


- > DataType
- > Entry
- > Extension
- > Reference
- > Resource
- > Section
- > Utils
- > ValueSet


-  CCD.liquid
-  ConsultationNote.liquid
-  DischargeSummary.liquid
-  Header.liquid
-  HistoryandPhysical.liquid
- { } metadata.json
-  OperativeNote.liquid
-  ProcedureNote.liquid
-  ProgressNote.liquid
-  ReferralNote.liquid
-  TransferSummary.liquid

---

- > ECR
- > HL7v2
- > Json
- > Stu3ToR4



**HL7 FHIR® Implementation Guide: Electronic Case Reporting (eCR) - US Realm**  
 2.1.0 - STU 2 



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HL7 FHIR® Implementation Guide: Electronic Case Reporting (eCR) - US Realm, published by HL7 Public Health Work Group (<http://www.hl7.org/Special/committees/ghr/index.cfm>). This is not an authorized publication; it is the continuous build for version 2.1.0. This version is based on the current content of <https://ghrpub.com/HL7/case-reporting/> and changes regularly. See the [Directory of published versions](#) if

## 10 Artifacts Summary

This page provides a list of the FHIR artifacts defined as part of this implementation guide.

### 10.0.1 eICR Profiles

eICR Composition	This Composition profile represents an electronic initial case report (eICR). It is based on and further constrains the US Public Health Composition.
eICR Country of Nationality Observation	This Observation profile represents the patient's country of nationality.
eICR Country of Residence Observation	This Observation profile represents the patient's country of usual residence.
eICR Document Bundle	This Bundle profile represents an eICR Document Bundle. It contains an eICR Composition.
eICR Encounter	This Encounter profile represents the encounter related to the event.
eICR Procedure	This Procedure profile defines constraints on the US Care Procedure profile for the eICR use case.
eICR ServiceRequest	This ServiceRequest profile represents eICR laboratory orders and other diagnostics for the eICR event.
eICR Vaccine Credential Patient Assertion Observation	This Observation profile represents whether or not the patient has asserted that they have verifiable vaccine credentials.

### 10.0.2 Reportability Response Profiles

RR Composition	This Composition profile represents the Reportability Response that is created in response to an electronic Initial Case Report Composition.
RR Document Bundle	This Bundle profile represents an RR Document Bundle. It contains either an RR Composition.
RR DocumentReference	This profile represents external resources such as a text guidance, link to access forms for additional reporting needs, additional testing and/or laboratory testing needs, treatment and/or prevention resources, Public Health Agency contact information and general additional resources.
RR eICR Processing Status Extension	This Extension profile represents the eICR processing status.

**Contents:**

- eICR Profiles
- Reportability Response Profiles
- eRSD Profiles/Instances
- US Public Health Content Profiles
- US Public Health Architecture Profiles
- Transport Profiles
- US Public Health Extensions
- Extensions
- eICR Examples
- Reportability Response Examples
- eRSD Packaging
- eRSD Examples
- Subscription Examples
- Transport Examples
- US Public Health Examples
- Terminology: US Public Health Code Systems
- Terminology: US Public Health Value Sets
- Terminology: Code Systems
- Terminology: Value Sets
- Terminology: Examples
- Capability Statements
- Other

# FHIR eICR & RR Profiles

## Usage:

- Use this Resource Profile: [eICR Document Bundle](#)
- Examples for this Resource Profile: [Composition/composition-eicr-pertassi-dka](#) and [Composition/composition-eicr-dka](#)

### 10.1.1.1 Formal Views of Profile Content

Description of Profiles, Differentials, Snapshots and how the different presentations work if.

Differential Table	Key Elements Table	Snapshot Table	Statistics/References	All																																																																																																					
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# End Result - eCR (XML) -> eCR (FHIR)

```

2 <realmCode code="US"/>
3 <typeId extension="POCD_HD000040" root="2.16.840.1.113883.1.3"/>
4 <templateId root="1.2.840.114350.1.72.1.51693"/>
5 <templateId root="2.16.840.1.113883.10.20.22.1.1"/>
6 <templateId extension="2015-08-01" root="2.16.840.1.113883.10.20.22.1.1"/>
7 <templateId extension="2016-12-01" root="2.16.840.1.113883.10.20.15.2"/>
8 <id root="8675309a-7754-r2d2-c3p0-973d9f777777"/>
9 <code code="55751-2" codeSystem="2.16.840.1.113883.6.1" codeSystemName="LOINC" displayName="Initial Public Health Case Report"/>
10 <title>Initial Public Health Case Report</title>
11 <effectiveTime value="20230409130417-0700"/>
12 <confidentialityCode code="N" codeSystem="2.16.840.1.113883.5.25" displayName="Normal" />
13 <languageCode code="en-US"/>
14 <setId assigningAuthorityName="EPC" extension="8675309a-7754-r2d2-c3p0-973d9f777777" />
15 <versionNumber value="2"/>
16 <recordTarget>
17 <patientRole>
18 <id extension="MRN8675309" root="1.2.840.114350.1.13.297.3.7"/>
19 <addr use="HP">
20 <streetAddressline>123 FAKE ST</streetAddressline>
21 <city>LOS ANGELES</city>
  
```

```

2 "resourceType": "Bundle",
3 "type": "batch",
4 "entry": [
5 {
6   "fullUrl": "urn:uuid:9ff73818-324a-0422-ada2-638d44296652",
7   "resource": {
8     "resourceType": "Composition",
9     "id": "9ff73818-324a-0422-ada2-638d44296652",
10    "meta": {
11      "profile": [
12        "http://hl7.org/fhir/us/ecr/StructureDefinition/eicr-composition"
13      ]
14    },
15    "identifier": [
16      {
17        "use": "official",
18        "type": {
19          "coding": [
20            {
21              "code": "55751-2",
22              "display": "Initial Public Health Case Report",
23              "system": "http://loinc.org"
24            }
25          ]
26        }
27      },
28      {
29        "value": "8675309a-7754-r2d2-c3p0-973d9f777777"
30      }
31    ]
32  }
33 ]
  
```



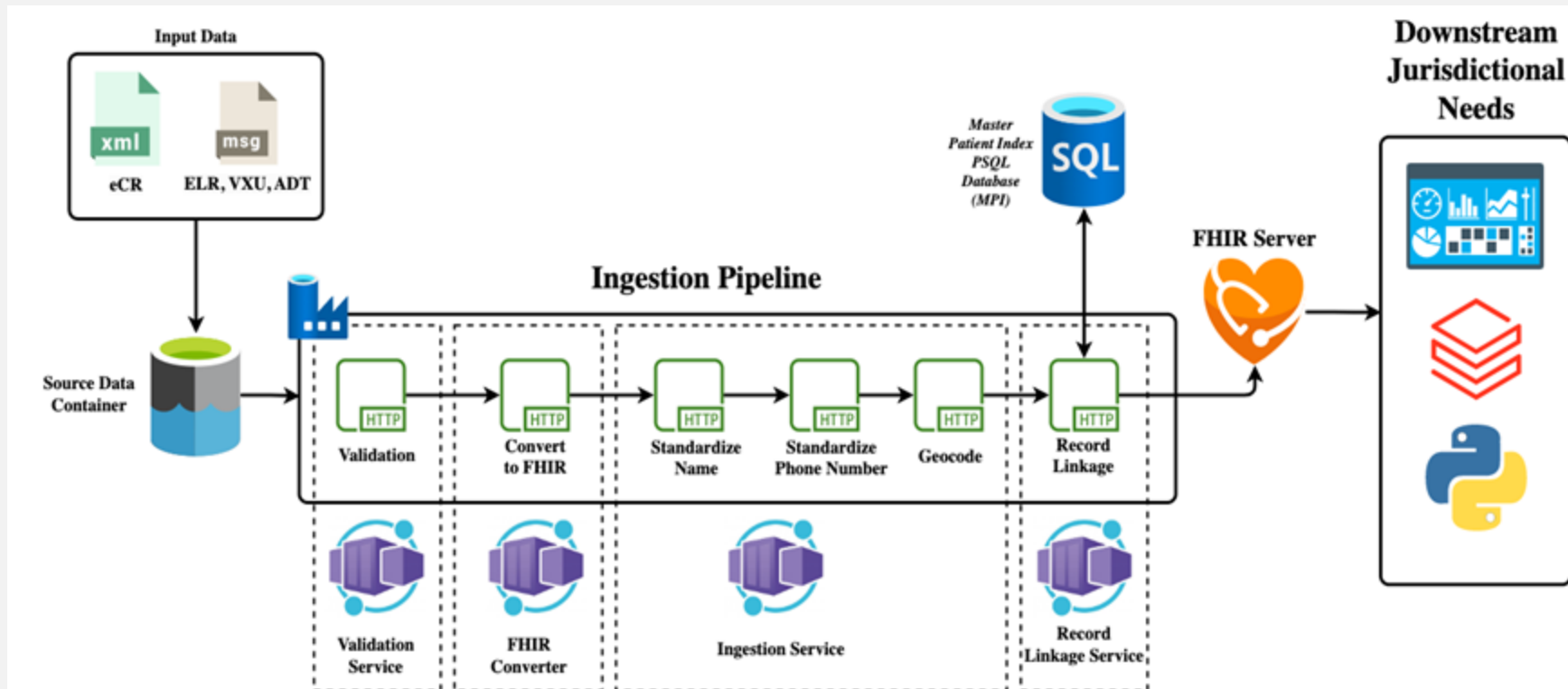
# End Result (Cont.)

```

17 <patientRole>
18   <id extension="MRN8675309" root="1.2.840.114350.1.13.297.3.7.3.688884.100"/>
19   <addr use="H">
20     <streetAddressLine>123 FAKE ST</streetAddressLine>
21     <city>LOS ANGELES</city>
22     <state>CA</state>
23     <postalCode>90062</postalCode>
24     <country>USA</country>
25     <useablePeriod xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
26       <low value="20181129"/>
27       <high nullFlavor="NA"/>
28     </useablePeriod>
29   </addr>
30   <telecom nullFlavor="UNK"/>
31   <patient>
32     <name use="L">
33       <given>Jessies</given>
34       <family>Girl</family>
35       <validTime>
36         <low nullFlavor="NA"/>
37         <high nullFlavor="NA"/>
38       </validTime>
39     </name>
40     <administrativeGenderCode code="F" codeSystem="2.16.840.1.113883.5">
41     <birthTime value="19810214"/>
    
```

```

{
  "fullUrl": "urn:uuid:34080650-1e86-08fe-c2c9-faa37629edd3",
  "resource": {
    "resourceType": "Patient",
    "id": "34080650-1e86-08fe-c2c9-faa37629edd3",
    "meta": {
      "profile": [
        "http://hl7.org/fhir/us/core/StructureDefinition/us-core-patient"
      ]
    },
    "identifier": [
      {
        "system": "urn:oid:1.2.840.114350.1.13.297.3.7.3.688884.100",
        "value": "MRN8675309"
      }
    ],
    "name": [
      {
        "use": "official",
        "family": "Girl",
        "given": [
          "Jessies"
        ]
      }
    ],
    "birthDate": "1981-02-14",
    "gender": "female",
    "extension": [
    ]
  }
}
    
```



## Learn More

- [Our GitHub PHDI Project where the FHIR Converter is located](https://github.com/CDCgov/phdi): <https://github.com/CDCgov/phdi>
- [CDC eCR Information](https://www.cdc.gov/ecr/index.html): <https://www.cdc.gov/ecr/index.html>
- [HL7 CDA ECR Implementation Guides](https://build.fhir.org/ig/HL7/cda-ccda-2.2/): <https://build.fhir.org/ig/HL7/cda-ccda-2.2/>
- [HL7 eICR and RR FHIR Profiles](http://build.fhir.org/ig/HL7/case-reporting/artifacts.html): <http://build.fhir.org/ig/HL7/case-reporting/artifacts.html>
- [GitHub Microsoft FHIR Converter](https://github.com/microsoft/FHIR-Converter): <https://github.com/microsoft/FHIR-Converter>

Thank you!

Skylight 