

Assignment #4 - HL7 V2.5 TO FHIR Mapping

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Original Example Message

We have this immunization message in HL7 V2.5 from the Maine immunization registry available for download from here:

<https://gist.github.com/diegokaminker/8eafa66e14cd4c77f89d109768bc0555>

You can copy the message and paste it in

<https://www.hl7inspector.com/>

Clicking in any segment / field (segment are lines, fields are separated by | - pipes) you can see the description of the content

HL7 V2.5.1 Implementation Guide from Maine

The implementation guide is available from here:

<https://www.maine.gov/dhhs/mecdc/infectious-disease/immunization/documents/ImmPact-HL7v2.5.1DataExchangeSpecs-v0.3-ME-9.2020.pdf>

Our organization needed to transform the immunization messages into FHIR to feed a clinical decision support system.

Proposed Mapping

One of the big consultancy companies (in fact, one of the big 7) sent a 18yo trainee who after three months asking questions and writing notes in an ipad, finally asked ChatGPT to create a template with the mapping from the HL7 V2.x message to a FHIR Message Bundle, and a table with the mapping, to help the implementers.

The results are below:

Mapping Table

{{segment.field}}	Value in our example message	HL7 V2.x Description	Resource.Element in Bundle
{{MSH.3}}	MyEMR	Sending Application	MessageHeader.source.name
{{MSH.4}}	DE-000001	Sending Facility	MessageHeader.source.endpoint
{{MSH.5}}		Receiving Application	MessageHeader.destination.name
{{MSH.7}}	20160701123030-0700	Date/Time of Message	MessageHeader.timestamp

{{MSH.9}}	VXU^V04^VXU_V04	Message Type	MessageHeader.eventCoding.code
{{MSH.10}}	CA0001	Message Control ID	MessageHeader.id
{{PID.3}}	PA123456	Patient Identifier List	Patient.id
{{PID.3.4}}	MYEMR	Assigning Authority	Patient.identifier.system
{{PID.5.1}}	JONES	Patient Name - Family	Patient.name.family
{{PID.5.2}}	GEORGE	Patient Name - Given	Patient.name.given
{{PID.5.3}}	M	Patient Name - Middle	Patient.name.given
{{PID.5.4}}	JR	Patient Name - Suffix	Patient.name.suffix
{{PID.7}}	20140227	Date/Time of Birth	Patient.birthDate
{{PID.8}}	M	Administrative Sex	Patient.gender
{{PID.11.1}}	1234 W FIRST ST	Patient Address - Street	Patient.address.line
{{PID.11.3}}	AUGUSTA	Patient Address - City	Patient.address.city
{{PID.11.4}}	ME	Patient Address - State	Patient.address.state
{{PID.11.5}}	4330	Patient Address - Zip	Patient.address.postalCode
{{PID.13.1}}	2075555555	Phone Number - Home	Patient.telecom.value
{{PID.15.1}}	ENG	Primary Language Code	Patient.communication.language.coding.code
{{PID.15.2}}	English	Primary Language	Patient.communication.language.coding.display
{{RXA.3}}	20140730	Administration Date	Immunization.occurrenceDateTime
{{RXA.5}}	8	Administered Code	Immunization.vaccineCode.coding.code
{{RXA.5.2}}	HEPB-PEDIATRIC/ADOLESCENT	Administered Description	Immunization.vaccineCode.coding.display
{{RXA.10}}	1245319599	Administered By	Practitioner.id

{{RXA.10.2}}	Smith	Administered By - Family	Practitioner.name.family
{{RXA.10.3}}	Janet	Administered By - Given	Practitioner.name.given
{{RXA.10.14}}	MD	Administered By - Degree	Practitioner.qualification.identifier.value
{{RXA.15}}	0039F	Lot Number	Immunization.lotNumber
{{RXA.16}}	20200531	Expiration Date	Immunization.expirationDate
{{RXA.17}}	MSD	Manufacturer	Immunization.manufacturer.reference
{{RXR.1}}	C28161	Route of Administration	Immunization.route.coding.code
{{RXR.1.2}}	INTRAMUSCULAR	Route Description	Immunization.route.coding.display
{{RXR.2}}	LA	Site of Administration	Immunization.site.coding.code
{{RXR.2.2}}	LEFT ARM	Site Description	Immunization.site.coding.display
{{OBX.3}}	64994-7	Observation Identifier	Observation.code.coding.code
{{OBX.3.2}}	Vaccine funding program eligibility category	Observation Description	Observation.code.coding.display
{{OBX.5}}	V03	Observation Value	Observation.valueCodeableConcept.coding.code
{{OBX.5.2}}	VFC eligibility – Not Insured	Observation Value Description	Observation.valueCodeableConcept.coding.display
{{OBX.14}}	20110701140500	Observation Date/Time	Observation.effectiveDateTime

Proposed Template

```
{
  "resourceType": "Bundle",
  "type": "message",
```

```
"entry": [  
  {  
    "resource": {  
      "resourceType": "MessageHeader",  
      "eventCoding": {  
        "system": "http://hl7.org/fhir/message-events",  
        "code": "{{MSH.9}}"  
      },  
      "source": {  
        "name": "{{MSH.3}}",  
        "endpoint": "urn:uuid:{{MSH.4}}"  
      },  
      "destination": [  
        {  
          "name": "{{MSH.5}}"  
        }  
      ],  
      "timestamp": "{{MSH.7}}",  
      "enterer": {  
        "reference": "Practitioner/{{RXA.10}}"  
      }  
    }  
  },  
  {  
    "resource": {  
      "resourceType": "Patient",  
      "id": "{{PID.3}}",  
      "identifier": [  
        {  
          "system": "urn:oid:{{PID.3.4}}",  
          "value": "{{PID.3}}"  
        }  
      ]  
    }  
  }  
]
```

```
],
"name": [
  {
    "family": "{{PID.5.1}}",
    "given": ["{{PID.5.2}}", "{{PID.5.3}}"],
    "suffix": ["{{PID.5.4}}"]
  }
],
"birthDate": "{{PID.7}}",
"gender": "{{PID.8}}",
"address": [
  {
    "line": ["{{PID.11.1}}"],
    "city": "{{PID.11.3}}",
    "state": "{{PID.11.4}}",
    "postalCode": "{{PID.11.5}}"
  }
],
"telecom": [
  {
    "system": "phone",
    "value": "{{PID.13.1}}",
    "use": "home"
  }
],
"communication": [
  {
    "language": {
      "coding": [
        {
          "system": "urn:oid:2.16.840.1.113883.6.96",
          "code": "{{PID.15.1}}",
```

```
        "display": "{{PID.15.2}}"
      }
    ]
  }
}
]
}
},
{
  "resource": {
    "resourceType": "Practitioner",
    "id": "{{RXA.10}}",
    "identifier": [
      {
        "system": "urn:oid:2.16.840.1.113883.4.6",
        "value": "{{RXA.10}}"
      }
    ],
    "name": [
      {
        "family": "{{RXA.10.2}}",
        "given": ["{{RXA.10.3}}"]
      }
    ],
    "qualification": [
      {
        "identifier": [
          {
            "system": "urn:oid:2.16.840.1.113883.4.6",
            "value": "{{RXA.10.14}}"
          }
        ]
      }
    ]
  }
}
```

```

    }
  ]
}
},
{
  "resource": {
    "resourceType": "Immunization",
    "status": "completed",
    "vaccineCode": {
      "coding": [
        {
          "system": "http://hl7.org/fhir/sid/cvx",
          "code": "{{RXA.5}}",
          "display": "{{RXA.5.2}}"
        }
      ]
    },
    "patient": {
      "reference": "Patient/{{PID.3}}"
    },
    "occurrenceDateTime": "{{RXA.3}}",
    "primarySource": true,
    "location": {
      "reference": "Location/{{MSH.4}}"
    },
    "lotNumber": "{{RXA.15}}",
    "expirationDate": "{{RXA.16}}",
    "site": {
      "coding": [
        {
          "system": "http://hl7.org/fhir/v3/ActSite",
          "code": "{{RXR.2}}",

```



```
        "display": "{{RXR.2.2}}"
      }
    ]
  },
  "route": {
    "coding": [
      {
        "system":
"http://hl7.org/fhir/v3/RouteOfAdministration",
        "code": "{{RXR.1}}",
        "display": "{{RXR.1.2}}"
      }
    ]
  }
}
},
{
  "resource": {
    "resourceType": "Observation",
    "status": "final",
    "code": {
      "coding": [
        {
          "system": "http://loinc.org",
          "code": "{{OBX.3}}",
          "display": "{{OBX.3.2}}"
        }
      ]
    }
  },
  "valueCodeableConcept": {
    "coding": [
      {
```

```
        "system":
"http://terminology.hl7.org/CodeSystem/v2-0064",
        "code": "{{OBX.5}}",
        "display": "{{OBX.5.2}}"
    }
]
},
"effectiveDateTime": "{{OBX.14}}"
}
}
]
```

Standard Mapping

There is a standardized mapping defined in the V2-to-FHIR implementation guide here:

<https://build.fhir.org/ig/HL7/v2-to-fhir/ConceptMap-message-vxu-v04-to-bundle.html>

Mapping Playground

You can also use the FHIR Mapping Playground at

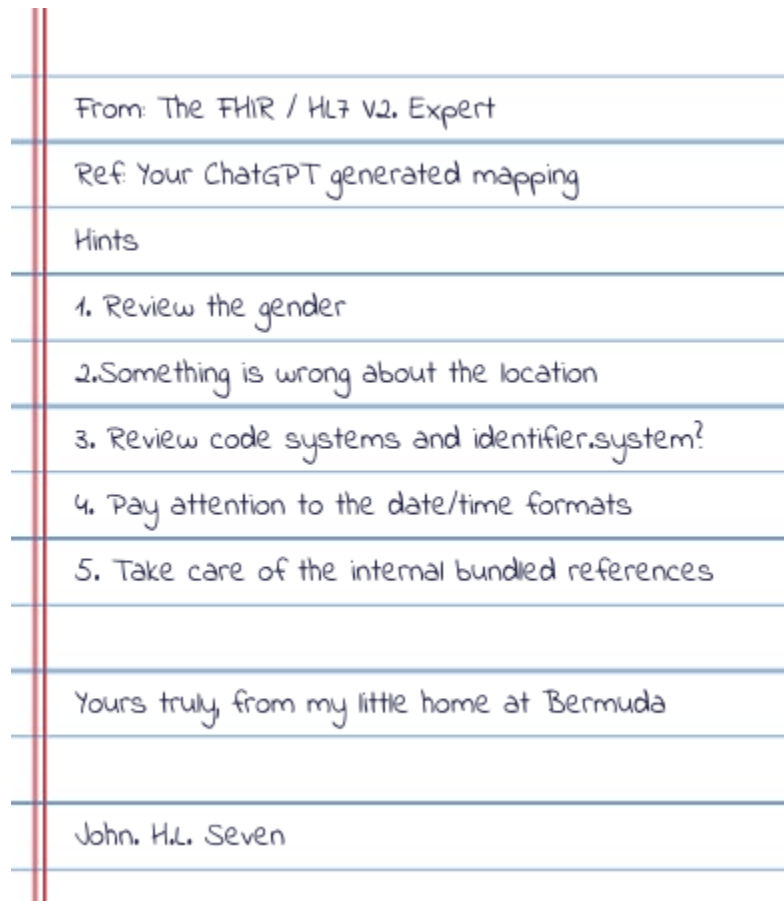
https://diegokaminker.github.io/mapping_playground/mapping.html

Your Job

Your job is to discuss some draft solutions for the problems -not all of them, there are more- with the mapping created by our trainee (and ChatGPT)

Hints from An Expert

An initial list of problems was created by an HL7 FHIR HL7 V2.x expert but he retired and is now living on a private island in Bermuda. He faxed some handwritten notes.



From: The FHIR / HL7 V2. Expert

Ref: Your ChatGPT generated mapping

Hints

1. Review the gender
2. Something is wrong about the location
3. Review code systems and identifier.system?
4. Pay attention to the date/time formats
5. Take care of the internal bundled references

Yours truly, from my little home at Bermuda

John. H.L. Seven


(Two days after leaving, he also recorded a message in our answering machine (we have one from the 90s): “Something happens with the manufacturer. Yes, please, another mojito”)

Preliminary Analysis

Let’s review each problem the HL7 Expert has pin-pointed, and you can suggest how to fix it

1. "Review the **gender**"

A) This is **gender** element definition as found in the FHIR R4 Patient spec.

 gender	Σ	0..1	code	male female other Binding: Administrative
---	---	------	------	--

B) This is the definition in HL7 table 0001 for Administrative Sex from the spec from Maine:

HL7 TABLES

0001-Sex (PID-8)

Value	Description	Definition
F	Female	Person reports that she is female.
M	Male	Person reports that he is male.
U	Unknown/undifferentiated	No assertion Is made about the gender of the person.

Discuss a proposed fix

2. “Something is wrong about the Location”

A) The location element in the Immunization resource is populated through the map as follows:

```
"location": {  
  "reference": "Location/{{MSH.4}}"}  
}
```

B) The problem is that both MSH.4 (Sending Facility) and RXA.11 (Administered-At Location) only contain a code for the Facility, so

i) the reference is pointing to a resource which is not in the Bundle

ii) We do not have any actual information on the location

Hint: Read the Messaging Profile...where are the locations defined? How is this information used?

Discuss proposed fixes

3. “Review code systems and identifier.system”

A) Examples of Code Systems and System identifiers for HL7 V2.x

NPI identifier, assigned by CMS:

▼ 10: 1245319599^Smith^Janet^^^^^^CMS^^^^NPI^^^^^^MD	↻	Administering Provider
1245319599	O	Number
Smith	O	Family Name
Janet	O	Given Name
CMS	O	Assigning Authority
NPI	O	Identifier Type Code
MD	O	Professional Suffix

Code from CDC for Race

▼ 10: 2106-3^WHITE^CDCREC	O	↻ Race
2106-3 (White)	O	Identifier
WHITE	O	Text
CDCREC	O	Name of Coding System

Code from CVX for Immunization

▼ 5: 08^HEPB-PEDIATRIC/ADOLESCENT^CVX		Administered Code
08 (Hep B, adolescent or pediatric)	O	Identifier
HEPB-PEDIATRIC/ADOLESCENT	O	Text
CVX	O	Name of Coding System

B) Required Structure and System identifiers in FHIR (same examples)

i) How to identify a practitioner using NPI in FHIR (<https://terminology.hl7.org/3.1.0/NamingSystem-npi.html>)

```
"identifier": [{  
  "system" = "http://hl7.org/fhir/sid/us-npi",  
  "value" = "1245319599"}]
```

ii) How to specify CDC terminology for Race (<https://hl7.org/fhir/us/core/StructureDefinition-us-core-race.html>)

```
"valueCoding" : {  
  "system" : "urn:oid:2.16.840.1.113883.6.238",  
  "code" : "2106-3",  
  "display" : "White"}
```

Note: this introduces another interesting mapping problem: in HL7 V2.x, Race is part of the demographic data for the patient, in FHIR, it is an extension defined in US Core!

ii) How to include a CVX code from Immunization (<https://terminology.hl7.org/3.1.0/CodeSystem-CVX.html>)

```
"vaccineCode": {  
  "coding": [  
    {  
      "system": "http://hl7.org/fhir/sid/cvx",  
      "code": "08",  
      "display": "HEPB-PEDIATRIC/ADOLESCENT"  
    }  
  ]  
}
```

Discuss proposed fixes

4. "Pay Attention to Date-Time Formats"

A) The date format in HL7 V2.x / from the Maine spec (example):

MSH-7: Date/time of message

The date and time the message was created.

This field is required.

Format: YYYYMMDDHHMMSS If sending more than 14 digits, the following format is required:

YYYY[MM[DD[HH[MM[SS[.S[S[S[S]]]]]]]]][+/-ZZZZ]

Example: 19970716192030.45+0100

B) The Date/Time Formats in FHIR are as follows (date, dateTime):

Date: YYYY-MM-DD

DateTime: YYYY-MM-DDThh:mm:ss+zz.zz

instant	<p>An instant in time in the format YYYY-MM-DDThh:mm:ss.sss+zz:zz (e.g. 2015-02-07T13:28:17.239+02:00 or 2017-01-01T00:00:00Z). The time SHALL include a time zone. Note: This is intended for when precisely observed times are required (typically system logs etc.), and not human times. For those, use date or dateTime (which can be as precise as <code>instant</code>, but is not required to be). <code>instant</code> is a more constrained dateTime</p> <p>Note: This type is for system times, not human times (see date and dateTime below).</p> <p>Regex: <code>([0-9]{4}-[0-9]{2}-[0-9]{2}T[0-9]{2}:[0-9]{2}:[0-9]{3}[+-][0-9]{2}:[0-9]{2})</code></p>
date	<p>A date, or partial date (e.g. just year or year + month) as used in human communication. The format is YYYY, YYYY-MM, or YYYY-MM-DD, e.g. 2018, 1973-06, 1905-08-23. There SHALL be no time zone. Dates SHALL be valid dates</p> <p>Regex: <code>([0-9]{4}-[0-9]{2}-[0-9]{2} [0-9]{4}-[0-9]{2} [0-9]{4})</code></p>
dateTime	<p>A date, date-time or partial date (e.g. just year or year + month) as used in human communication. The format is YYYY, YYYY-MM, YYYY-MM-DD or YYYY-MM-DDThh:mm:ss+zz:zz, e.g. 2018, 1973-06, 1905-08-23, 2015-02-07T13:28:17-05:00 or 2017-01-01T00:00:00.000Z. If hours and minutes are specified, seconds must be provided due to schema type constraints but may be zero-filled and may be ignored at receiver discretion. Dates SHALL be valid dates. time "24:00" is not allowed. Leap Seconds are allowed - see below</p> <p>Regex: <code>([0-9]{4}-[0-9]{2}-[0-9]{2}T[0-9]{2}:[0-9]{2}:[0-9]{3}[+-][0-9]{2}:[0-9]{2} [0-9]{4}-[0-9]{2}-[0-9]{2} [0-9]{4}-[0-9]{2} [0-9]{4})</code></p>

Discuss proposed fixes

5. “Take care of internal Bundle references”

References to resources inside of the same Bundle should be created using urn:uuid to allow the server solve the creation/update of resources

Each resource in a Bundle should contain an entry identifier (fullUrl) and a criteria in the url to add or update the contained resource. All references in the Bundle should point to the fullUrl of the referenced entry.

```
{
  "fullUrl": "urn:uuid:25131980-1b95-4548-a01d-94786b40e4c6",
  "request": {
    "method": "PUT",
    "url":
    "Patient?identifier=http://imm-messages.gov/MyEMR-DE-000004/patients|AD445566"
  },
  ... (in a resource related to the above)
  "reference": "urn:uuid:25131980-1b95-4548-a01d-94786b40e4c6"
  ...
}
```

Discuss proposed fixes

6. “Something happens with the manufacturer”

As some other data in the HL7 V2.x => FHIR template, the manufacturer was not included in the actual mapping.

Discuss proposed fixes