

Leveraging FHIR for IIS Bulk Data and Modernization

ONC 2023 Virtual Tech Forum
Modernizing Public Health Data Exchange:
Lessons Learned and Tools for the Road Ahead

September 21, 2023

Background: Immunization Information Systems (IIS)

- ❑ Confidential, population-based systems
- ❑ Collect and consolidate immunization data in a given jurisdiction
- ❑ Provide actionable information for clinical and public health decision making. (Source: CDC)

IIS Background (continued)

- Inbound data exchange:
 - HL7 version 2 Unsolicited Vaccination Update (VXU)
 - Flat file
 - Interactive web applications
- Outbound data exchange:
 - HL7 version 2 Query/Response (QBP/RSP)
 - Flat file (CDC Data Clearinghouse, HEDIS data, etc.)
 - Interactive web applications

FHIR in a Nutshell

- ❑ Fast Healthcare Interoperability Resources (FHIR)
- ❑ Next generation HL7 standard
- ❑ Set of Resources and a modern RESTful API for accessing them
- ❑ **FHIR Bulk Data** – FHIR-based approach for exporting large amounts of data from a FHIR server
- ❑ **SMART on FHIR** – health app interface based on FHIR and other open standards

FHIR Server Models

□ **FHIR Façade**

- Data translation – translate FHIR REST calls to the underlying legacy database or service (no native FHIR storage)
- Intermediate FHIR server – synchronize native FHIR storage to underlying legacy database or service

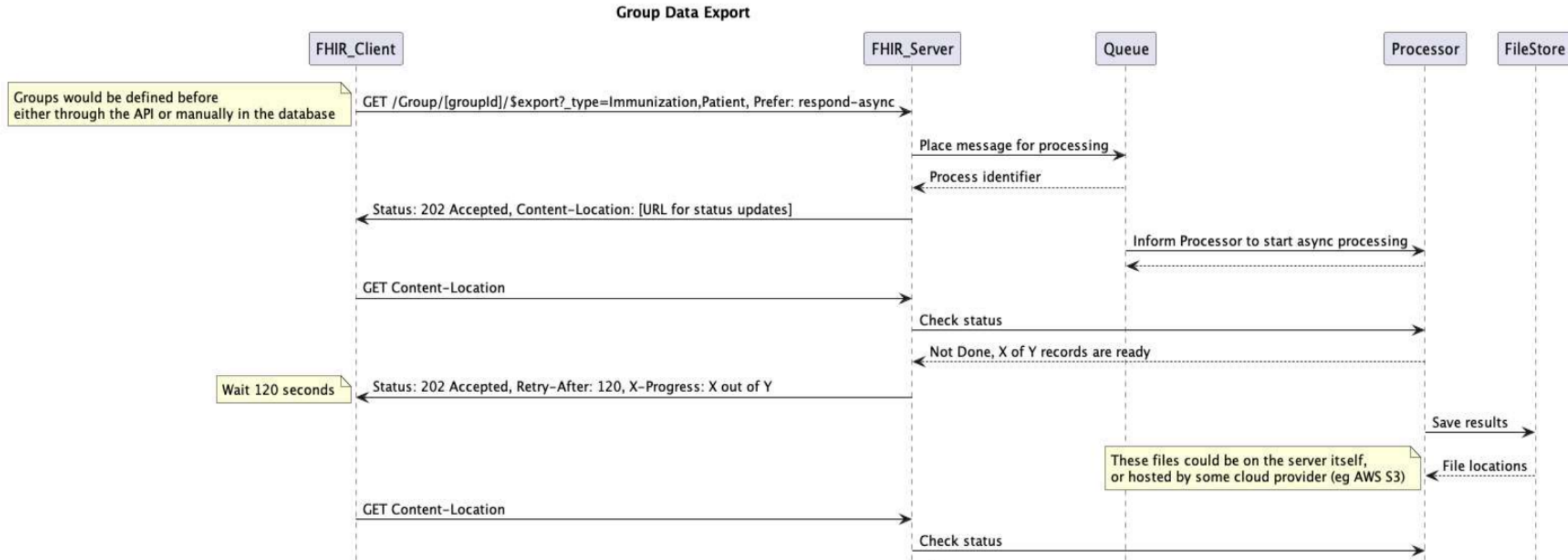
□ **Native FHIR server**

- FHIR storage is the operational data store

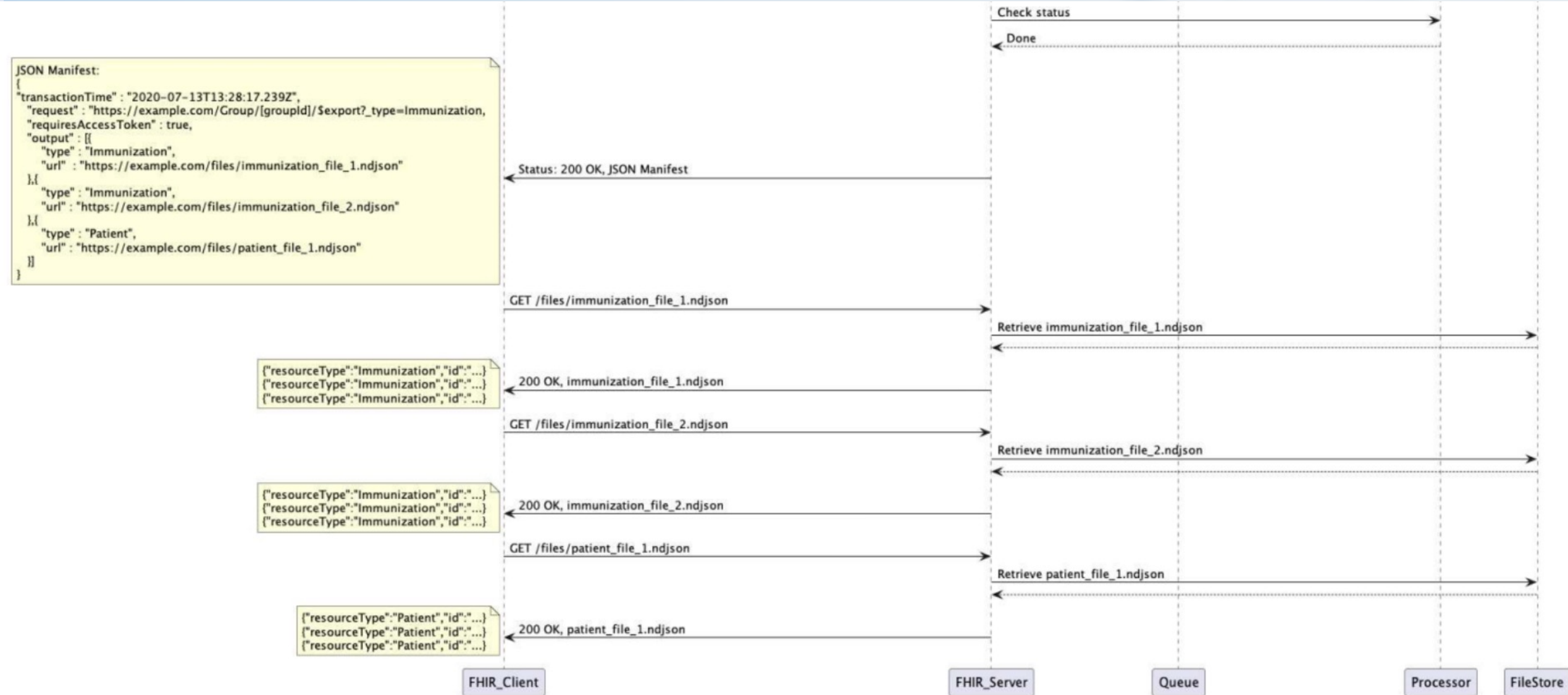
Why FHIR for IIS Data Access?

- ❑ Accessible to general purpose developers
- ❑ Modern APIs, software, tools, resources, and support
- ❑ FHIR Bulk Query:
 - Efficiently access up-to-date immunization data
 - Reduce redundant queries
 - Easy to parse bulk data format
 - Flexibility for different use cases: Hospitals, physicians, schools, payers, etc.
 - Modern authentication/authorization framework

Bulk FHIR Workflow for IIS



Bulk FHIR Workflow for IIS (continued)




Immunization FHIR Example

Patient Info

First Name: **TEST** Middle: **A** Last: **HIMSS-PATIENT**

Date of Birth: **04/20/2022**

Age: **10m 16d**

VALID DOSES					NEXT DUE
COVID-19 2 valid doses	10/20/2022 COV19 PF PFR 6m-5 6m 0d	11/20/2022 COV19 PF PFR 6m-5 7m 0d			Due Now (On or after 01/15/2023) Dose 3  Covid Record
Influenza					Due Now (On or after 10/20/2022) Dose 1
Hepatitis B 3 valid doses	04/20/2022 HepB ped/adol 0m 0d	06/20/2022 VAXELIS 2m 0d	08/20/2022 VAXELIS 4m 0d [1]	10/20/2022 VAXELIS 6m 0d	End of Series
DTaP/DT/Tdap/Td 3 valid doses	06/20/2022 VAXELIS 2m 0d	08/20/2022 VAXELIS 4m 0d	10/20/2022 VAXELIS 6m 0d		Due in the Future (07/20/2023 - 12/17/2023) Dose 4
Pneumo 1 valid doses	06/20/2022 PCV15 2m 0d				Past Due
Polio 3 valid doses	06/20/2022 VAXELIS 2m 0d	08/20/2022 VAXELIS 4m 0d	10/20/2022 VAXELIS 6m 0d		Due in the Future (04/20/2026 - 05/17/2029) Dose 4
Hib 3 valid doses	06/20/2022 VAXELIS 2m 0d	08/20/2022 VAXELIS 4m 0d	10/20/2022 VAXELIS 6m 0d		Due in the Future (04/20/2023 - 09/16/2023) Dose 4
Rotavirus 0 valid doses					Maximum Age Reached

```

"name": {
  {
    "text": "TEST A HIMSS-PATIENT",
    "family": "HIMSS-PATIENT",
    "given": [
      "TEST",
      "A"
    ]
  }
},
"birthDate": "2022-04-20",

```

```

status": "completed",
"vaccineCode": {
  "coding": [
    {
      "system": "http://hl7.org/fhir/sid/cvx",
      "code": "215",
      "display": "PCV15"
    }
  ],
  "text": "Pneumococcal conjugate PCV15, polysaccharide CRM197 con:
},
"patient": {
  "reference": "11469529",
  "type": "Patient"
},
"occurrenceDateTime": "2022-06-20",
"recorded": "2023-01-01T07:10:39-05:00",
"primarySource": true,
"manufacturer": {
  "reference": "MSD",
  "type": "Organization",
  "display": "Merck & Co., Inc."
},
"lotNumber": "FK0101",
"expirationDate": "2024-01-01",
"site": {
  "coding": [
    {
      "system": "http://terminology.hl7.org/CodeSystem/v2-0163",
      "code": "LA",
      "display": "LEFT ARM"
    }
  ]
}

```

*Courtesy of the Rhode Island IIS

Rhode Island IIS Implementation

- ❑ Rhode Island Child and Adult Immunization Registry (RICAIR)
- ❑ FHIR Façade Model (with translation layer) using open source HAPI FHIR server and SMART Backend Services Authorization
- ❑ Bulk Query:
 - Predefined Groups, or search and define custom groups
 - Query Patient, Immunization, ImmunizationRecommendation, and ImmunizationEvaluation resources
 - Download up to 100k patients or more in a fraction of the time of HL7 v2 QBP/RSP
 - Server has flexibility in scheduling and allocating resources to query

Helios FHIR Accelerator for Public Health

- ❑ Part of the **Immunization Integration Program (IIP)**
Workgroup – collaborative to improve EHR/IIS interoperability
 - Convening Partners: CDC, AIRA, HIMSS, Drummond & SME Consultants
- ❑ **IIS Bulk Data Query - Make Data in Public Health Systems Accessible in Bulk**
 - Leverage bulk FHIR to develop a uniform process for querying IIS data
 - Develop Implementation Guidance & vision for bulk data exchange
 - Test & pilot solutions

RI IIS Bulk FHIR – Helios Status

Functionality	FHIR functionality	Status
Bulk Data Export	Group/[id]/\$export	Tested at January Connectathon; US Core Support enhanced for June Helios virtual event; Available for use - Soliciting potential partners
Patient Match	Patient/\$match	Tested at June Helios virtual event
Creation of Group resource	POST /Group {“member” [...] }	Tested at June Helios virtual event
Add Patient to Group	Group/[id]/\$member-add	Tested at June Helios virtual event
Remove Patient from Group	Group/[id]/\$member-remove	Tested at June Helios virtual event
Security/authentication – SMART Backend Services (OAuth/JWT)	/.well-known/smart-configuration POST /auth/token	Tested at June Helios virtual event
Bulk Match (Argonaut)	Patient/\$match with [1..*]	Prototype implementation ready for testing at next Connectathon

Now that we have a FHIR server, what else can we do with it?

03 / 01 / 2021	ADMINISTERING PRO...	FK0101	DTaP,IPV,Hib,HepB (Vaxelis) ...	GlaxoSmithKline (for...	01 / 01 / 2024
03 / 01 / 2021	ADMINISTERING PRO...	FK0101	Pneumococcal conjugate PCV...	Merck & Co., Inc.	01 / 01 / 2024
05 / 01 / 2021	ADMINISTERING PRO...	FK0101	DTaP,IPV,Hib,HepB (Vaxelis) ...	GlaxoSmithKline (for...	01 / 01 / 2024
05 / 01 / 2021	ADMINISTERING PRO...	FK0101	Pneumococcal conjugate PCV...	Merck & Co., Inc.	10 / 10 / 2024
07 / 01 / 2021	ADMINISTERING PRO...	FK0101	DTaP,IPV,Hib,HepB (Vaxelis) ...	GlaxoSmithKline (for...	01 / 01 / 2024
07 / 01 / 2021	ADMINISTERING PRO...	FK0101	Pneumococcal conjugate PCV...	Merck & Co., Inc.	01 / 01 / 2024
01 / 01 / 2022	ADMINISTERING PRO...	FK0102	Measles, Mumps,Rubella, live ...	Merck & Co., Inc.	01 / 01 / 2024

Information

Immunization record added for patient 11468369, MMR given on 1/1/2023
Immunization record added for patient 11468369, MMR given on 1/1/2022

Okay

IIS Web App – FHIR behind the scenes

Name
_search?lot-number:exact=FK0102&_sort=-expiration-...
_search?lot-number:exact=FK0102&_sort=-expiration-...
_search?lot-number:exact=FK0102&_sort=-expiration-...
_search?lot-number:exact=FK0102&_sort=-expiration-...
fhir/
11468369
_search?patient=Patient/11468369&_sort=date
ValueSet
_search?type=prov&_count=1000
_search?type=bus&_count=1000

× Headers **Payload** Preview Response Initiator Timing Cookies

▼ Request Payload view source

▼ {resourceType: "Bundle", type: "batch", total: 2,...}

▼ entry: [{request: {url: "Immunization?updateProvider=false", method: "POST"},...},...]

▼ 0: {request: {url: "Immunization?updateProvider=false", method: "POST"},...}

▼ request: {url: "Immunization?updateProvider=false", method: "POST"}

method: "POST"

url: "Immunization?updateProvider=false"

▼ resource: {resourceType: "Immunization", status: "completed", id: "11468369.03.2023-01-01",...}

▼ doseQuantity: {system: "http://unitsofmeasure.org", unit: "mL", value: 0.5}

system: "http://unitsofmeasure.org"

unit: "mL"

value: 0.5

expirationDate: "2024-01-01"

▼ extension: [{url: "https://health.ri.gov/immunization-source-of-update", valueString: "01"}]

▼ 0: {url: "https://health.ri.gov/immunization-source-of-update", valueString: "01"}

url: "https://health.ri.gov/immunization-source-of-update"

valueString: "01"

id: "11468369.03.2023-01-01"

lotNumber: "FK0102"

▼ manufacturer: {type: "Organization", reference: "MSD", display: "Merck & Co., Inc."}

display: "Merck & Co., Inc."

Leveraging FHIR Bulk Data for DMI

- ❑ FHIR Server for IIS can double as an application modernization strategy
- ❑ Replace legacy web applications with modern front-ends that communicate with the FHIR back-end:
 - Immunization Data Entry/Update
 - Other potential uses:
 - Immunization Display, Patient Demographics, SMART Health Cards, School Forms, etc.
 - SMART on FHIR apps
 - Consumer apps
 - IIS-to-IIS - IZ Gateway

Thank you!

□ Acknowledgements:

- Rhode Island Child and Adult Immunization Registry (RICAIR) and CDC
- Helios – The HL7 FHIR Accelerator for Public Health
- Immunization Integration Program (IIP)
- American Immunization Registry Association (AIRA)
- HLN Rhode Island Team

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