

# Analyzing FHIR data using ML and Analytical tools

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# Introduction

## Ranvijay Kumar

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### Agenda

- Complexities in FHIR Data
- Common analytics and solution patterns
  - Quick demos
- Q&A



# Complexities in FHIR data

- Hierarchical
- Heavily nested
- Remember to handle
  - Choice types
  - Modifier extensions
  - Recursion
  - Invariants
  - References

```

"identifier": [
  {
    "use": "usual",
    "type": {
      "coding": [
        {
          "system": "http://terminology.hl7.org/CodeSystem/v2-0203",
          "code": "MR"
        }
      ]
    },
    "system": "urn:oid:1.2.36.146.595.217.0.1",
    "value": "12345",
    "period": {
      "start": "2001-05-06"
    },
    "assigner": {
      "display": "Acme Healthcare"
    }
  }
],

```

```

{
  "resourceType": "MedicationRequest",
  "modifierExtension": [{
    "url": "http://example.org/fhir/StructureDefinition/anti-prescription",
    "valueBoolean": true
  }],
  .. other content ...
}

```

effective[x]	Σ	0..1
effectiveDateTime		dateTime
effectivePeriod		Period

Name	Flags	Card.	Type
Questionnaire	I <b>TU</b>		DomainResource
item	I	0..*	BackboneElement
item	I	0..*	see item

Invariants **Affect this element**

**obs-7** Rule If Observation.code is the same as an Observation.component.code then the value element associated with the code SHALL NOT be present

subject	Σ	0..1	Reference(Patient   Group   Device   Location)
focus	Σ <b>TU</b>	0..*	Reference(Any)

## Common analytics patterns

- Self-service analytics
- Case-based analytics
- DW/DM scenarios

## Self-service analytics

Answering questions by directly querying the FHIR server in the absence of an EDW.

- Solution pattern
  - FHIR Queries
  - PowerBI connector for FHIR

*“What is the trend and population profile of COVID-19 hospitalization?”*

*“What is the impact of COVID-19 on outpatient appointments?”*

# Case-based analytics

Analyzing a subset of data with a specific objective.

Ex: Study of Multisystem Inflammatory Syndrome (MIS-C) in COVID-19 infected Children

Solution pattern:

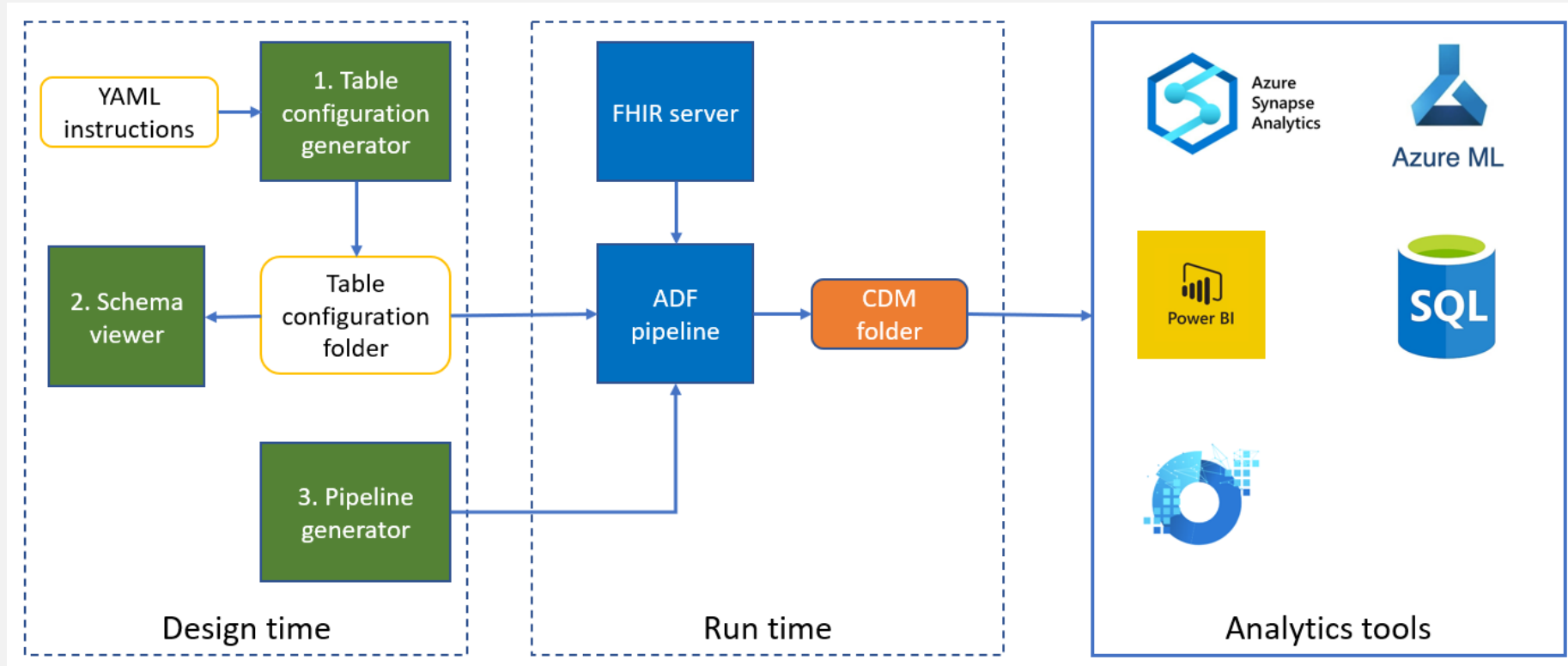
- FHIR \$export to Azure storage
  - Creation of cohorts using FHIR Group
  - Use of `_since` for periodic export
- De-identified export by Azure API for FHIR
- Analyze using
  - Synapse
  - Azure ML
  - Azure Databricks

## DW/DM

Loading FHIR data and combining it with data from other sources into an enterprise DW

- Solution patterns
  - FHIR Analytics Pipelines
    - Optional De-identification
  - Custom ETL pipelines

# FHIR analytics pipelines OSS tool



<https://github.com/microsoft/FHIR-Analytics-Pipelines>



## Summary

- Make use of FHIR affordances
- Beware of FHIR data idiosyncrasies
- Use the right set of tool for your scenario

## Related sessions

- **FHIR Fusion: Analytics on Combined Clinical and Imaging Data**  
Steven Borg, Tuesday, June 8th, 11:00 am-11:45 am

## Resources

- [Azure API for FHIR](#)
- [PowerBI Connector for FHIR](#)
- [Azure Synapse Analytics](#)
- [Azure Machine Learning](#)
- [FHIR analytics Pipelines OSS tool](#)

## Contact

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# Q&A

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