ClinFHIR Hands on Tutorial
AMIA Fall Symposium 2019
Washington DC

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For Meeting Materials and in room webex info
https://tinyurl.com/CoF-AMIA-Fall-2019
This Hands-On Session

• Goals
  • Learn ClinFHIR tool
  • Explore FHIR resources and their relationships
  • Introduce scenario modeling

• Webex use
  • [www.webex.com](http://www.webex.com) Join by number: 807 039 596 PWD AMIA2019
  • Allows for “close up” viewing of detailed screens
  • Be sure to use the tools such as zooming etc within webex as you need to

• Set-up
  • Recommend Chrome Browser
  • If you have numeric keypad CTRL+-/- zooms in and out
    • Use this if some items are off the screen or hard to read.
    • (On some laptops you can use CTRL-FCN to access the numeric keypad overlay)
  • Keep a notepad handy to jot down information

• Open ClinFHIR.com
Getting to Know the ClinFHIR.com Main Page

Main modules (open in new tab)  Older modules (open in new tab)

Patient Viewer
Display resources for a specific patient, using a number of different views such as a list by resource type, JSON & tree views, encounters by condition, numeric Observation charting and graphical relationship views.
There is also the option to add a new patient, and to create sample data for that patient.

Graph Builder
Build graphs of inter-connected FHIR resources.
This is the successor to Scenario Builder

Logical Modeler
The Logical modeler allows the creation of a model that represents a particular interoperability requirement in a format that is easy to use. It uses FHIR datatypes, and can be based on an existing resource type or completely 'ad hoc'. It is intended to act as a 'bridge' between Modeler and User, and can act as the basis for the generation of the profiling components required by FHIR.
Models are saved on the Conformance Server. Can reference ValueSets from the Terminology server.
Create a Resources Model
Create an Information Model

Server Query
Supports ad hoc queries against any FHIR server. Includes a simple query builder. The response can be displayed as JSON or a Tree view, and FHIPath is supported.
Can access any compliant FHIR server (must expose a Capability Statement)

Scenario Builder
The Scenario Builder is used to join together the resources needed to represent a specific clinical scenario. It can use Core Resource types, Profiles and Logical models as it does this. The intention is to help people understand how resources can tell a clinical story, and to validate that the resource types available (including profiles) are sufficient.
Create a simple scenario
Create a Document
Adding structured data to a scenario

Resource Validator
Validate a resource, or bundle of resources, by calling one or more validation servers.
A resource can be supplied either by pasting it into the app, or by providing a URI to a resource instance. Select the servers you wish to validate the resource and the results will be displayed in summary and detailed formats.

Bundle Visualizer
Various displays for the contents of a bundle. Bundles can be pasted into the viewer and optionally saved in the data server.
Same ClinFHIR Main Page – Zoomed in.
ClinFHIR Modules
- Patient Viewer
- Server Query
- Scenario Builder
- Logical Modeler
- Implementation Guide Browser
- Extension Definition Builder
- Code System Builder
- Value Set Explorer

Each opens in new tab
Server Selection

Setting FHIR Servers

- **Data Server**
  Where your information is stored
- **Conformance Server**
  Enforces conformance to FHIR spec
- **Terminology Server**
  Vocabulary source

Follow recommendations during tutorial
Useful FHIR Links

Subject to change
ClinFHIR Video Demos

ClinFHIR videos

Scenario Builder
Adding structured data
Logical Modeller
Logical Modeller and Scenario Builder
RESTful query tool

Subject to version variations
Terminology Links

Other Links
- SNOMED browser
- SHRIMP (Terminology browser)

Subject to version variations
Task – Recap

• Open clinfhir.com
• Set up an account – DO NOT REUSE AN OLD PW
• Set up your servers –
  • Data Server – hapiR4
  • Conformance – NZProjectR4
  • Terminology – OntoserverR4 (Terminology)
### Step 1: Create A User Account

- **Main modules (open in new tab)**
  - **Patient Viewer**: Display resources for a specific patient, using a number of different views such as a list by resource type, JSON & tree views, encounters by condition, numeric Observation charting and graphical relationship views. There is also the option to add a new patient, and to create sample data for that patient.
  - **Graph Builder**: Build graphs of inter-connected FHIR resources. This is the successor to Scenario Builder.
  - **Logical Modeler**: The Logical modeler allows the creation of a model that represents a particular interoperability requirement in a format that is easy to use. It uses FHIR datatypes, and can be based on an existing resource type or completely 'ad hoc'. It is intended to act as a 'bridge' between Modeler and User, and can act as the basis for the generation of the profiling components required by FHIR. Models are saved on the Conformance Server. Can reference ValueSets from the Terminology server. Create a Resources Model/Create an Information Model.
  - **Server Query**: Supports ad hoc queries against any FHIR server. Includes a simple query builder. The response can be displayed as Json or a tree view, and FHIRPath is supported.
  - **Scenario Builder**: The Scenario Builder is used to join together the resources needed to represent a specific clinical scenario. It can use Core Resource types, Profiles and Logical models as it does this. The intention is to help people understand how resources can tell a clinical story, and to validate that the resource types available (including profiles) are sufficient. Note the builder still has issues with more complex resource types - this is a work in progress.
  - **Resource Validator**: Validate a resource, or bundle of resources, by calling one or more validation servers.
  - **Bundle Visualizer**: Various displays for the contents of a bundle. Bundles can be pasted into the viewer and optionally saved in the data server.

### Current servers

- **Data Server**: Public HAPI STU3 server
- **Conformance Server**: Public HAPI STU3 server
- **Terminology Server**: Ontoserver/R3 (terminology)

### FHIR Links (open in new tab)

- R4 Specification (current)
- STU-3 Specification
- STU-2 Specification
- FHIR Chat
- FHIR.org
- Clinicians Workshop

### clinFHIR Videos (open in new tab)

- Scenario Builder
- Adding structured data
- Logical Modeler
- Logical Modeler and Scenario Builder
- RESTful query tool

Note that some of these videos may describe earlier versions, so may not completely match the current functionality.

Thanks to Rhapsody Health for supporting the development of clinFHIR.
Create User Account

WARNING!!
This is an UNSECURED server! Use a dummy password!

When you login the first time this becomes your user name and password. You may need to pick a different user name if its already in use.
Step 2 - Server Selection

Current servers

Data Server: hapiR4
Conformance Server: NZProjectR4
Terminology Server: OntoserverR4 (terminology)

USE THESE!!!!
Open Patient Viewer module
<table>
<thead>
<tr>
<th>Main modules (open in new tab)</th>
<th>Experimental modules (open in new tab)</th>
</tr>
</thead>
</table>
| **Patient Viewer**  | Display resources for a specific patient, using a number of different views such as a list by resource type, json & tree views, encounters by condition, numeric Observation charting and graphical relationship views.  
There is also the option to add a new patient, and to create sample data for that patient. | Patient resources are stored on the Data Server. The server should support the Patient/$everything operation. |
| **Server Query**  | Supports ad hoc queries against any FHIR server. Includes a simple query builder. The response can be displayed as Json or a Tree view, and FHIRPath is supported. | Can access any compliant FHIR server (must expose a Capability Statement) |
| **Scenario Builder**  | The Scenario Builder is used to join together the resources needed to represent a specific clinical scenario. It can use Core Resource types, Profiles and Logical models as it does this. The intention is to help people understand how resources can tell a clinical story, and to validate that the resource types available (including profiles) are sufficient | Patient information is on the Data Server. Profiles on the Conformance server. ValueSets on the Terminology server |
Please select a patient using the 'Select Patient' button at the upper right.

If you want to add a new patient, then click the 'Select Patient' button, and in the modal dialog that appears, there's a link to add a new patient.
Selecting a Patient

Search for Patient

1. Enter name: Betsy
2. Enter Id
3. Enter Identifier

Betsy Johnson female 1957-11-07

Add new patient
Search for Patient

betsy

Enter id of patient on this server

Enter identifier of patient

Betsy Johnson female 1957-11-07

Add new patient
Task – Select and View Patient

• Go to Patient Viewer Module
• Enter “Betsy” in Patient Search
• Select “Betsy Johnson” patient
• Explore patient’s FHIR resources
Patient Viewer – Resource Explorer

1. Resource Types
2. Condition resources
3. Type 2 diabetes
4. Outward references
5. Versions
Patient Viewer – Resource Reference Graph

Note that the Patient is not displayed in this graph.

Scroll to zoom graph
Click and drag to move
Click on a resource in the diagram. See the details on the right.
Task – Select and View Patient

• Go to Patient Viewer Module
• Enter “Betsy” in Patient Search
• Select “Betsy Johnson” patient
• Explore patient’s FHIR resources
• Create a sample patient and view the data
Patient Viewer

Please select a patient using the 'Select Patient' button at the upper right.

If you want to add a new patient, then click the 'Select Patient' button, and in the modal dialog that appears, there's a link to add a new patient.
Task – Add new patient

Search for Patient

Search

Load

Enter Id of patient on this server

Search

Enter Identifier of patient

Betsy Johnson female 1957-11-07

Add new patient
Create Basic Set of Resources

Add new Patient

Identifier
Identifier should be unique

First Name
Hanley

Last Name
Strappman

Date of Birth
2019-08-01
Age: 2 weeks

Gender
Male
Female

Generate samples

Add patient

Find existing patient
Add new Patient

Progress...
Adding Hanley Strappman
Added patient with the id: 144872
Checking that the required reference resources exist
adding Conditions...
Added Conditions List
adding Encounters...
added encounters Added 10 Encounters
Added 30 Observations
Added Medications List
Added 2 Appointments
Added Allergies List

All resources have been created. Click the close button to return to the front page
You can review the resource instances that were created using the 'Details' link at the upper left on the screen.
Add new Patient

Progress...
Adding Hanley Strappman
Added patient with the id: 144716
Checking that the required reference resources exist
Adding Conditions...
Added Conditions List
Adding Encounters...
added encounters Added 10 Encounters
Added 30 Observations
Added Medications List
Added 2 Appointments
Added Allergies List

All resources have been created. Click the close button to return to the previous page.
You can review the resource instances that were created using the Patient Viewer.

Patient Viewer
Hanley Strappman male 1955-08-22 (144872)

Resource explorer
Resource references graph
Numeric Observations/Vitals
Encounter time

Resource Types
resources

AllergyIntolerance 2
Appointment 2
Condition 11
Encounter 10
List 3
MedicationStatement 19
Observation 30
Patient 1
Practitioner 2

Show Patient Json
Condition resources

- rheumatoid arthritis - both hands
- depression
- neuropathic pain
- high cholesterol
- onychomycosis
- rheumatoid arthritis - left elbow
- GERD
- diabetes
- hypertension
- angina
- asthma

Outward references

- Condition subject: Patient/144872
- Hanley Strappman

Inward references

- List/144873, item
  - Problem list
- Encounter/144880, condition
  - Aug 20th 2019 for sore throat
- Encounter/144893, condition
  - Jul 2nd 2019 for sore throat
That was the Patient Viewer Module...

Now let’s look at the Scenario Builder Module
Scenario Builder Module

Main modules (open in new tab)   Older modules (open in new tab)

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HL7 International
### The Scenario Builder

<table>
<thead>
<tr>
<th>Scenario Builder</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Scenario Builder is used to join together the resources needed to represent a specific clinical scenario. It can use Core Resource types, Profiles and Logical models as it does this. The intention is to help people understand how resources can tell a clinical story, and to validate that the resource types available (including profiles) are sufficient. Note that the builder still has issues with more complex resource types - this is a work in progress.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Logical Modeller</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Logical modeller allows the creation of a model that represents a particular</td>
<td>Models are saved on the</td>
</tr>
</tbody>
</table>

Code Snippet:

```

Create a simple scenario
Adding structured data to a scenario
Create a Document
```

**Helpful Blogs by the developer**

- Create a simple scenario
- Adding structured data to a scenario
- Create a Document
Links to the blogs direct from this deck.....

Creating FHIR Resource INSTANCES

https://fhirblog.com/creating-a-simple-scenario/

Adding Structured Data

https://fhirblog.com/adding-structured-data-to-a-scenario/

Time Check – set working time....
Create New Scenario

To edit a scenario, you can either:
- Click the 'New Scenario' link to the left to create a new Set
- Select the Library of scenarios ('View Library' link to the upper right) and download one to edit or view
Create new scenario

Name:
Clinicians on FHIR Tutorial

Description:

Category:
Default

Save
Note: Scenarios are saved locally and need to be posted to a server in order to be shared. Stay tuned!
Task – Create a Patient (15 min)

• Use Scenario Builder module to create your own patient
  • Include a name, gender and birthdate
  • Record patient name and id on your note to find it later
• Validate your resource instance
• Update (POST) the resource to the data server
• Confirm that your patient is on the data server using the Patient Viewer module and the patient id
Add HumanName property to Patient.name

Use: Usual

First Name: Hanley
Middle Name: Middle
Last Name: Strappman
Suffix:

Result: Hanley Strappman
1. Select data element
2. Look at value set
3. Validate resource
Validate Resource

1. Confirm valid resource
2. Validate all resources & Post resource to server
3. Resource id of resource on the server
Create FHIR Condition Instance
Task – Create a Condition (15 min)

- Use Scenario Builder module to create your own condition
  - SNOMED Code and link to your patient
  - E.g. Diabetes mellitus type 2 (SCTID 44054006)
- Validate your resource instance
- Update (POST) the resource to the data server
- Confirm that your patient is on the data server using the Patient Viewer module and the patient id
- Add additional conditions if you are done early
Add CodeableConcept property to Condition.category

- [ ] Encounter Diagnosis
- [x] Problem List Item
### Local Scenarios

**New Scenario**

<table>
<thead>
<tr>
<th>List</th>
<th>Description</th>
<th>Graph</th>
<th>FHIRPath</th>
<th>Mark</th>
<th>Add Resource</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinicians on FHIR Tutorial</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Hypertension

**Condition of:** 1566530207489

**Structure & Reference**

<table>
<thead>
<tr>
<th>Type</th>
<th>Text</th>
<th>Valid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition</td>
<td>Hypertension</td>
<td></td>
</tr>
<tr>
<td>Patient</td>
<td>Hanley Strappman</td>
<td></td>
</tr>
</tbody>
</table>

#### Hypertension

- **identifier**: Hypertension
- **clinicalStatus**: 
- **verificationStatus**: 
- **category**: 
- **severity**: 
- **code**: "1"
- **bodySite**: 
- **subject**: 
- **encounter**: 
- **onset**: 
- **abatement**: 
- **recordedDate**: 
- **recorder**: 
- **asserter**: 
- **stage**: 
- **evidence**: 
- **note**: 

**ValueSet Binding (example)**

**Identification of the condition, problem or diagnosis.**
### SNOMED Coded Condition Concept

#### ValueSet Browser:

Expand | Description | All concepts in Compose | JSON
---|---|---|---

**Filter**

- hypertension

ValueSet/condition-code?expand?filter=hypertension

<table>
<thead>
<tr>
<th>Code</th>
<th>System</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>38341003</td>
<td><a href="http://snomed.info/sct">http://snomed.info/sct</a></td>
<td>Hypertension</td>
</tr>
<tr>
<td>10725009</td>
<td><a href="http://snomed.info/sct">http://snomed.info/sct</a></td>
<td>Benign hypertension</td>
</tr>
<tr>
<td>48146000</td>
<td><a href="http://snomed.info/sct">http://snomed.info/sct</a></td>
<td>Diastolic hypertension</td>
</tr>
<tr>
<td>59997006</td>
<td><a href="http://snomed.info/sct">http://snomed.info/sct</a></td>
<td>Endocrine hypertension</td>
</tr>
<tr>
<td>59621000</td>
<td><a href="http://snomed.info/sct">http://snomed.info/sct</a></td>
<td>Essential hypertension</td>
</tr>
<tr>
<td>429198000</td>
<td><a href="http://snomed.info/sct">http://snomed.info/sct</a></td>
<td>Exertional hypertension</td>
</tr>
<tr>
<td>123800009</td>
<td><a href="http://snomed.info/sct">http://snomed.info/sct</a></td>
<td>Goldblatt hypertension</td>
</tr>
<tr>
<td>162659009</td>
<td><a href="http://snomed.info/sct">http://snomed.info/sct</a></td>
<td>Hypertension resolved</td>
</tr>
<tr>
<td>697929007</td>
<td><a href="http://snomed.info/sct">http://snomed.info/sct</a></td>
<td>Intermittent hypertension</td>
</tr>
<tr>
<td>70272006</td>
<td><a href="http://snomed.info/sct">http://snomed.info/sct</a></td>
<td>Malignant hypertension</td>
</tr>
<tr>
<td>288250001</td>
<td><a href="http://snomed.info/sct">http://snomed.info/sct</a></td>
<td>Maternal hypertension</td>
</tr>
<tr>
<td>208560001</td>
<td><a href="http://snomed.info/sct">http://snomed.info/sct</a></td>
<td>Neonatal hypertension</td>
</tr>
</tbody>
</table>
Enter search term

Add CodeableConcept property to Condition.code

ben

Bends
- Does bend
- Penis bent
- Cutaneous bends
- Able to bend
- Benzoze syndrome
- Bend arm position
- Benign haematuria

Benign hypertension
- Benign meningioma
- Benign paraproteinaemia
- Benign pemphigus
- Benign phaeochromocytoma
- Benign pneumoconiosis
- Bent bone dysplasia
- Congenital bent clavicle
- Congenital bent humerus
- Congenital bent ilium
- Congenital bent ischium
- Congenital bent nose
- Congenital bent pubis
Add CodeableConcept property to Condition.code

Benign hypertension

http://snomed.info/sct  10725009  Benign hypertension

Text value if not coded
Hypertension
Condition of 156663207489

Condition.code
- currentValue
- CodeableConcept
- ValueSet Binding (example)
- Identification of the condition, problem or diagnosis.

Condition
- identifier
- clinicalStatus
- verificationStatus
- category
- severity
- code
- bodySite
- subject
- encounter
- onset
- abatement
- recordedDate
- recorder
- assertor
- stage
- evidence
- note
Link Condition to Patient Resource

1. Select \texttt{subject}[x] data element
2. Appropriate data types
3. Available datatypes in this scenario
Note: ClinFHIR automatically links new resources to existing patient resource when appropriate
View Resource Graph of Scenario

- **Scenario Builder**
- **Local Scenarios**
  - Clinicians on FHIR Tutorial

**Graph View**
- **Title**: Condition Hypertension
- **Subject**: Patient Harley Hargeman

**Structure & Reference**
- **Current resource views**
  - Hypertension
- **Changes**
  - Toggle Input Mode

**Details**
- Identifier *
- clinicalStatus
- verificationStatus
- category *
- severity
- code
- bodySite *
- subject
- of encounter
- onset[x]
- abatement[x]
- recordedDate
- of recorder
- of asserter
- stage *
- evidence *
- note *
Task – Add conditions to Problem List

• Use Scenario Builder module to create another condition
  • SNOMED Code and link to your patient for
    • Asthma
    • Diabetes

TRY THIS!
Bonus Round – Even if you don't get here, you can still play the game at home.
Task - Create other resources

• Add an observation (or two)
  • HgA1c
  • Blood Pressure
• Add a Medication** *(see next slide)*
• Add a Practitioner resource
• Add an Encounter resource
• Add a List resource
Medications According to FHIR....

• **Medication**
  • Primarily used for the identification and definition of a medication for the purposes of prescribing, dispensing, and administering a medication as well as for making statements about medication use.

• **MedicationAdministration**
  • Describes the event of a patient consuming or otherwise being administered a medication.

• **MedicationDispense**
  • Indicates that a medication product is to be or has been dispensed for a named person/patient. The medication dispense is the result of a pharmacy system responding to a medication order.

• **MedicationKnowledge**
  • Information about a medication that is used to support knowledge.

• **MedicationRequest**
  • An order or request for both supply of the medication and the instructions for administration of the medication to a patient.

• **MedicationUsage**
  • A record of a medication that is being consumed by a patient.
Task – Create an Observation (15min)

• Use Scenario Builder module to create your own Observation
  • Try Fasting Blood Glucose, Height, Weight and BMI
• Use FHIR Spec, Google or LOINC Browser to find LOINC concept code
• Validate your resource instance
• Update (POST) the resource to the data server
• Confirm that your patient is on the data server using the Patient Viewer module and the patient id
• Additional task – add additional observations
Add HgbA1c Observation
Use Value Set Expand to find code
Add CodeableConcept property to Observation.code

Hemoglobin A1c in Blood

http://loinc.org  55454-3  Hemoglobin A1c in Blood

Text value if not coded
Current Value
Hemoglobin A1c in Blood

Data type(s) (click to add data)

Describes what was observed. Sometimes this is called the observation "name".
Add Quantity Value to Observation

<table>
<thead>
<tr>
<th>Type</th>
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<th>Valid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition</td>
<td>Hypertension</td>
<td>✓</td>
</tr>
<tr>
<td>Observation</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Patient</td>
<td>Harley Strappman</td>
<td>✓</td>
</tr>
</tbody>
</table>

Add a value to the observation
Add Quantity property to `Observation.valueQuantity`

Value: 7.0

System: Enter units as string (eg mmHg)
Validate and POST Observation
Did you make it this far?

Congratulations!

MISSION COMPLETE