

Tutorial: Advanced FHIR Shorthand and Tools

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 INFERNO mCODE™ SYNTHEA Clinical
Quality
Language FHIR®
Short™

Track overview: Let's Build a FHIR specification

Introduction to FHIR
11:00 – 11:45

Introduction Profiling
1:00 – 1:45

Accelerating your IG production
1:00 – 1:45

FHIR Registry & Packages
1:00 – 1:45



Profiling with Forge
2:15 – 3:00



IG with IG Publisher
2:15 – 3:00



Publishing with Simplifier.net
2:15 – 3:00

Create an IG with
FHIR Shorthand
3:15 – 4:00



Create an IG with
FHIR Shorthand
4:15 – 5:00



Advanced FHIR Shorthand
and Tools
3:15 – 4:00



You are here

Monday

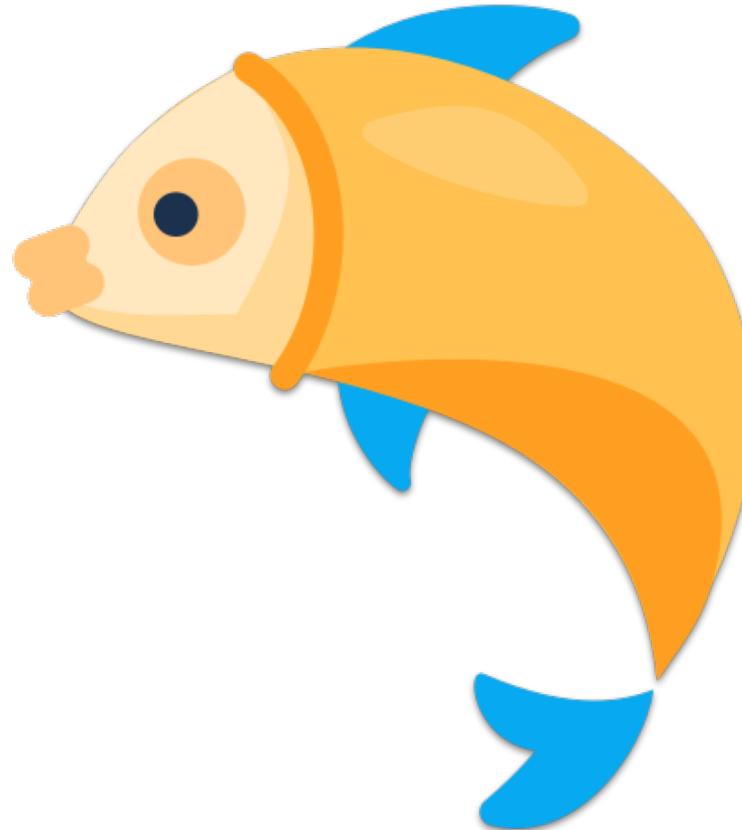
Tuesday

Wednesday

Thursday



Background



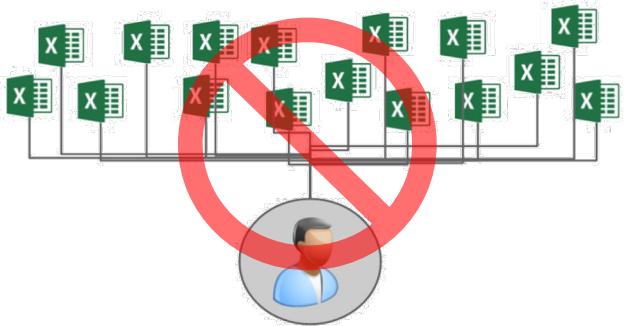
Profiling Approaches



Hand-Editing



Spreadsheets



User Interfaces



Forge

Profile on Patient⁽⁵⁾: PatienNL

Properties Narrative Element Tree Element Grid Xml

Edit the meta properties of the selected resource or component.

URL

<http://hl7.org/fhir/StructureDefinition/PatienNL>

Resource ID

Name

PatienNL

Description

StructureDefinition for a Dutch Patient.

Command-Driven



MAKE ME A SANDWICH.



Profile: MyPatient

Parent: Patient

* name 1...* MS

Example: COVID-19 Diagnosis Profile

Profile: CovidDiagnosis

Parent: Condition

Description: "How to report COVID"

* code = \$icd#U07.1

* severity from CovidSeverityVS (required)

* subject only Reference(Patient)

* subject 1..1

Alias: \$icd = <http://hl7.org/fhir/sid/icd-10-cm>



What's New in FSH STU Two

*Get it? Fish stew?
(Don't worry, he'll be fine. FSH will survive this one.)*

Explicit Indexing

```
* item[0].linkId = "sp-101"
* item[0].text = "What is your date of birth?"
* item[0].type = #date

* item[1].linkId = "sp-102"
* item[1].text = "What is your country of birth?"
* item[1].type = #code

* item[2].linkId = "sp-103"
* item[2].text = "What country do you currently reside in?"
* item[2].type = #code

* item[3].linkId = "sp-104"
* item[3].text = "What country did you travel to?"
* item[3].type = #code

* item[4].linkId = "sp-105"
* item[4].text = "When did the travel start?"
* item[4].type = #date

* item[5].linkId = "sp-106"
* item[5].text = "When did the travel end?"
* item[5].type = #date
```



Problems with explicit indexing:

- Error prone (oops, I missed one!)
- Adding/removing items in the middle requires renumbering
- Similar blocks of code are not reusable

```
* item[ ].linkId = "sp-108"
* item[ ].text = "When state do you currently reside in?"
* item[ ].type = #code
```

Soft Indexing

```
* item[+].LinkId = "sp-101"
* item[=].text = "What is your date of birth?"
* item[=].type = #date

* item[+].LinkId = "sp-102"
* item[=].text = "What is your country of birth?"
* item[=].type = #code

* item[+].LinkId = "sp-103"
* item[=].text = "What country do you currently reside in?"
* item[=].type = #code

* item[+].LinkId = "sp-104"
* item[=].text = "What country did you travel to?"
* item[=].type = #code

* item[+].LinkId = "sp-105"
* item[=].text = "When did the travel start?"
* item[=].type = #date

* item[+].LinkId = "sp-106"
* item[=].text = "When did the travel end?"
* item[=].type = #date
```



Soft indexing approach:

- [+] → next item in array
- [=] → last referenced item in the array
- Start an empty array with [+] or [0] or implicit index 0

```
* item[+].LinkId = "sp-108"
* item[=].text = "When state do you currently reside in?"
* item[=].type = #code
```

Advantages of soft indexing:

- No need to count (counting is hard!)
- Easily add/remove/move items
- Copy/paste and RuleSet friendly

Parameterized RuleSets (a.k.a. Macros)

RuleSet: name(parameter1, *parameter2*, *parameter3*...)

- * rule1
- * rule2
- // More rules

```
RuleSet: Context(path)
* ^context[+].type = #element
* ^context[=].expression = "{path}"

Extension: OrganizationPreferredContact
* insert Context(Organization.contact)
* value[x] only boolean
```

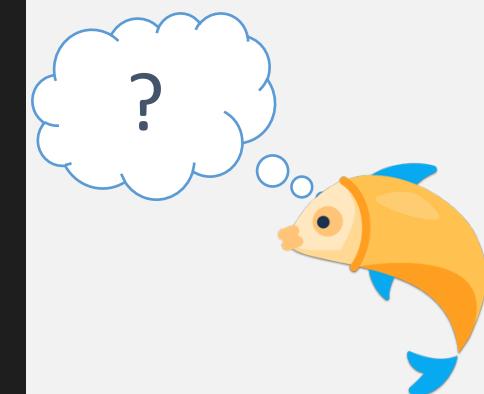


```
Extension: OrganizationPreferredContact
* ^context[+].type = #element
* ^context[=].expression = "Organization.contact"
* value[x] only boolean
```

- **Defining parameterized RuleSets**
 - Use the same **RuleSet** keyword as normal RuleSets
 - Follow the name w/ list of parameter names in parentheses
 - Wrap parameter name in curly braces to use its value in rules
- **Inserting parameterized RuleSets**
 - Use the same **insert** keyword as normal insert rules
 - Follow the name w/ list of parameter values in parentheses
 - Parameter values are inserted as text strings (nothing fancy!)

CapabilityStatement Example

```
// MeasureReport requirements
* rest.resource[0].type = #MeasureReport
* rest.resource[0].extension[0].url = "http://hl7.org/fhir/StructureDefinition/capabilitystatement-expectation"
* rest.resource[0].extension[0].valueCode = #SHALL
* rest.resource[0].supportedProfile[0] = "http://hl7.org/fhir/us/saner/StructureDefinition/PublicHealthMeasureReport"
* rest.resource[0].supportedProfile[0].extension[0].url = "http://hl7.org/fhir/StructureDefinition/capabilitystatement-expectation"
* rest.resource[0].supportedProfile[0].extension[0].valueCode = #SHALL
* rest.resource[0].interaction[0].code = #create
* rest.resource[0].interaction[0].extension[0].url = "http://hl7.org/fhir/StructureDefinition/capabilitystatement-expectation"
* rest.resource[0].interaction[0].extension[0].valueCode = #SHALL
* rest.resource[0].interaction[1].code = #update
* rest.resource[0].interaction[1].extension[0].url = "http://hl7.org/fhir/StructureDefinition/capabilitystatement-expectation"
* rest.resource[0].interaction[1].extension[0].valueCode = #SHALL
// Measure requirements
* rest.resource[1].type = #Measure
* rest.resource[1].extension[0].url = "http://hl7.org/fhir/StructureDefinition/capabilitystatement-expectation"
* rest.resource[1].extension[0].valueCode = #SHALL
* rest.resource[1].supportedProfile[0] = "http://hl7.org/fhir/us/saner/StructureDefinition/PublicHealthMeasure"
* rest.resource[1].supportedProfile[0].extension[0].url = "http://hl7.org/fhir/StructureDefinition/capabilitystatement-expectation"
* rest.resource[1].supportedProfile[0].extension[0].valueCode = #SHOULD
* rest.resource[1].supportedProfile[1] = "http://hl7.org/fhir/us/saner/StructureDefinition/PublicHealthMeasureStratifier"
* rest.resource[1].supportedProfile[1].extension[0].url = "http://hl7.org/fhir/StructureDefinition/capabilitystatement-expectation"
* rest.resource[1].supportedProfile[1].extension[0].valueCode = #SHOULD
* rest.resource[1].interaction[0].code = #create
* rest.resource[1].interaction[0].extension[0].url = "http://hl7.org/fhir/StructureDefinition/capabilitystatement-expectation"
* rest.resource[1].interaction[0].extension[0].valueCode = #SHOULD
* rest.resource[1].interaction[1].code = #update
* rest.resource[1].interaction[1].extension[0].url = "http://hl7.org/fhir/StructureDefinition/capabilitystatement-expectation"
* rest.resource[1].interaction[1].extension[0].valueCode = #SHOULD
```



Loosely based on <https://build.fhir.org/ig/HL7/fhir-saner/>

CapabilityStatement Example: Soft Indexing & Aliases

```
// MeasureReport requirements
* rest.resource[0].type = #MeasureReport
* rest.resource[=].extension[0].url = $ExpExt
* rest.resource[=].extension[=].valueCode = #SHALL
* rest.resource[=].supportedProfile[0] = "http://hl7.org/fhir/us/saner/StructureDefinition/PublicHealthMeasureReport"
* rest.resource[=].supportedProfile[=].extension[0].url = $ExpExt
* rest.resource[=].supportedProfile[=].extension[=].valueCode = #SHALL
* rest.resource[=].interaction[0].code = #create
* rest.resource[=].interaction[=].extension[0].url = $ExpExt
* rest.resource[=].interaction[=].extension[=].valueCode = #SHALL
* rest.resource[=].interaction[+].code = #update
* rest.resource[=].interaction[=].extension[0].url = $ExpExt
* rest.resource[=].interaction[=].extension[=].valueCode = #SHALL
// Measure requirements
* rest.resource[+].type = #Measure
* rest.resource[=].extension[0].url = $ExpExt
* rest.resource[=].extension[=].valueCode = #SHALL
* rest.resource[=].supportedProfile[0] = "http://hl7.org/fhir/us/saner/StructureDefinition/PublicHealthMeasure"
* rest.resource[=].supportedProfile[=].extension[0].url = $ExpExt
* rest.resource[=].supportedProfile[=].extension[=].valueCode = #SHOULD
* rest.resource[=].supportedProfile[+] = "http://hl7.org/fhir/us/saner/StructureDefinition/PublicHealthMeasureStratifier"
* rest.resource[=].supportedProfile[=].extension[0].url = $ExpExt
* rest.resource[=].supportedProfile[=].extension[=].valueCode = #SHOULD
* rest.resource[=].interaction[0].code = #create
* rest.resource[=].interaction[=].extension[0].url = $ExpExt
* rest.resource[=].interaction[=].extension[=].valueCode = #SHOULD
* rest.resource[=].interaction[+].code = #update
* rest.resource[=].interaction[=].extension[0].url = $ExpExt
* rest.resource[=].interaction[=].extension[=].valueCode = #SHOULD
```



Loosely based on <https://build.fhir.org/ig/HL7/fhir-saner/>

CapabilityStatement Example: Parameterized RuleSets

```
RuleSet: SupportResource (resource, expectation)
* rest.resource[+].type = {resource}
* rest.resource[=].extension[0].url = $ExpExt
* rest.resource[=].extension[0].valueCode = {expectation}

RuleSet: SupportProfile (profile, expectation)
* rest.resource[=].supportedProfile[+] = {profile}
* rest.resource[=].supportedProfile[=].extension[0].url = $ExpExt
* rest.resource[=].supportedProfile[=].extension[0].valueCode = {expectation}

RuleSet: SupportInteraction (interaction, expectation)
* rest.resource[=].interaction[+].code = {interaction}
* rest.resource[=].interaction[=].extension[0].url = $ExpExt
* rest.resource[=].interaction[=].extension[0].valueCode = {expectation}
```

```
// MeasureReport requirements
* insert SupportResource(#MeasureReport, #SHALL)
* insert SupportProfile("http://hl7.org/fhir/us/saner/StructureDefinition/PublicHealthMeasureReport", #SHALL)
* insert SupportInteraction(#create, #SHALL)
* insert SupportInteraction(#update, #SHALL)
```

Loosely based on <https://build.fhir.org/ig/HL7/fhir-saner/>

CapabilityStatement Example: Comparing Approaches

FSH STU1 Representation

```

Instance: TestCapabilityStatement
InstanceOf: CapabilityStatement
Usage: #example
* status = #active
* date = "2020-12-18"
* kind = #requirements
*fhirVersion = #4.0.1
* format[0] = #json
* rest.mode = #server
// MeasureReport requirements
* rest.resource[0].type = #MeasureReport
* rest.resource[0].extension[0].url = "http://hl7.org/fhir/StructureDefinition/capabilitystatement-expectation"
* rest.resource[0].extension[0].valueCode = #SHALL
* rest.resource[0].supportedProfile[0] = "http://hl7.org/fhir/us/saner/StructureDefinition/PublicHealthMeasureReport"
* rest.resource[0].supportedProfile[0].extension[0].url = "http://hl7.org/fhir/StructureDefinition/capabilitystatement-expectation"
* rest.resource[0].supportedProfile[0].extension[0].valueCode = #SHALL
* rest.resource[0].interaction[0].code = #create
* rest.resource[0].interaction[0].extension[0].url = "http://hl7.org/fhir/StructureDefinition/capabilitystatement-expectation"
* rest.resource[0].interaction[0].extension[0].valueCode = #SHALL
* rest.resource[0].interaction[1].code = #update
* rest.resource[0].interaction[1].extension[0].url = "http://hl7.org/fhir/StructureDefinition/capabilitystatement-expectation"
* rest.resource[0].interaction[1].extension[0].valueCode = #SHALL
// Measure requirements
* rest.resource[1].type = #Measure
* rest.resource[1].extension[0].url = "http://hl7.org/fhir/StructureDefinition/capabilitystatement-expectation"
* rest.resource[1].extension[0].valueCode = #SHALL
* rest.resource[1].supportedProfile[0] = "http://hl7.org/fhir/us/saner/StructureDefinition/PublicHealthMeasure"
* rest.resource[1].supportedProfile[0].extension[0].url = "http://hl7.org/fhir/StructureDefinition/capabilitystatement-expectation"
* rest.resource[1].supportedProfile[0].extension[0].valueCode = #SHOULD
* rest.resource[1].supportedProfile[1] = "http://hl7.org/fhir/us/saner/StructureDefinition/PublicHealthMeasureStratifier"
* rest.resource[1].supportedProfile[1].extension[0].url = "http://hl7.org/fhir/StructureDefinition/capabilitystatement-expectation"
* rest.resource[1].supportedProfile[1].extension[0].valueCode = #SHOULD
* rest.resource[1].interaction[0].code = #create
* rest.resource[1].interaction[0].extension[0].url = "http://hl7.org/fhir/StructureDefinition/capabilitystatement-expectation"
* rest.resource[1].interaction[0].extension[0].valueCode = #SHOULD
* rest.resource[1].interaction[1].code = #update
* rest.resource[1].interaction[1].extension[0].url = "http://hl7.org/fhir/StructureDefinition/capabilitystatement-expectation"
* rest.resource[1].interaction[1].extension[0].valueCode = #SHOULD
// Location requirements
* rest.resource[2].type = #Location
* rest.resource[2].extension[0].url = "http://hl7.org/fhir/StructureDefinition/capabilitystatement-expectation"
* rest.resource[2].extension[0].valueCode = #SHALL
* rest.resource[2].supportedProfile[0] = "http://hl7.org/fhir/us/saner/StructureDefinition/saner-resource-location"
* rest.resource[2].supportedProfile[0].extension[0].url = "http://hl7.org/fhir/StructureDefinition/capabilitystatement-expectation"
* rest.resource[2].supportedProfile[0].extension[0].valueCode = #SHOULD
* rest.resource[2].interaction[0].code = #create
* rest.resource[2].interaction[0].extension[0].url = "http://hl7.org/fhir/StructureDefinition/capabilitystatement-expectation"
* rest.resource[2].interaction[0].extension[0].valueCode = #SHOULD
* rest.resource[2].interaction[1].code = #update
* rest.resource[2].interaction[1].extension[0].url = "http://hl7.org/fhir/StructureDefinition/capabilitystatement-expectation"
* rest.resource[2].interaction[1].extension[0].valueCode = #SHOULD
// QuestionnaireResponse requirements
* rest.resource[3].type = #QuestionnaireResponse
* rest.resource[3].extension[0].url = "http://hl7.org/fhir/StructureDefinition/capabilitystatement-expectation"
* rest.resource[3].extension[0].valueCode = #SHALL
* rest.resource[3].supportedProfile[0] = "http://hl7.org/fhir/us/saner/StructureDefinition/SanerQuestionnaireResponse"
* rest.resource[3].supportedProfile[0].extension[0].url = "http://hl7.org/fhir/StructureDefinition/capabilitystatement-expectation"
* rest.resource[3].supportedProfile[0].extension[0].valueCode = #SHALL
* rest.resource[3].interaction[0].code = #create
* rest.resource[3].interaction[0].extension[0].url = "http://hl7.org/fhir/StructureDefinition/capabilitystatement-expectation"
* rest.resource[3].interaction[0].extension[0].valueCode = #SHALL
* rest.resource[3].interaction[1].code = #update
* rest.resource[3].interaction[1].extension[0].url = "http://hl7.org/fhir/StructureDefinition/capabilitystatement-expectation"
* rest.resource[3].interaction[1].extension[0].valueCode = #SHALL

```

Soft Indices and Aliases

```

Alias: $ExpExt = http://hl7.org/fhir/StructureDefinition/capabilitystatement-expectation

Instance: TestCapabilityStatement2
InstanceOf: CapabilityStatement
Usage: #example
* status = #active
* date = "2020-12-18"
* kind = #requirements
* fhirVersion = #4.0.1
* format[0] = #json
* rest.mode = #server
// MeasureReport requirements
* rest.resource[0].type = #MeasureReport
* rest.resource[0].extension[0].url = $ExpExt
* rest.resource[0].extension[0].valueCode = #SHALL
* rest.resource[0].supportedProfile[0] = "http://hl7.org/fhir/us/saner/StructureDefinition/PublicHealthMeasureReport"
* rest.resource[0].supportedProfile[0].extension[0].url = $ExpExt
* rest.resource[0].supportedProfile[0].extension[0].valueCode = #SHALL
* rest.resource[0].interaction[0].code = #create
* rest.resource[0].interaction[0].extension[0].url = $ExpExt
* rest.resource[0].interaction[0].extension[0].valueCode = #SHALL
* rest.resource[0].interaction[0].code = #update
* rest.resource[0].interaction[0].extension[0].url = $ExpExt
* rest.resource[0].interaction[0].extension[0].valueCode = #SHALL
// Measure requirements
* rest.resource[0].type = #Measure
* rest.resource[0].extension[0].url = $ExpExt
* rest.resource[0].extension[0].valueCode = #SHALL
* rest.resource[0].supportedProfile[0] = "http://hl7.org/fhir/us/saner/StructureDefinition/PublicHealthMeasure"
* rest.resource[0].supportedProfile[0].extension[0].url = $ExpExt
* rest.resource[0].supportedProfile[0].extension[0].valueCode = #SHOULD
* rest.resource[0].supportedProfile[0].extension[1] = "http://hl7.org/fhir/us/saner/StructureDefinition/PublicHealthMeasureStratif"
* rest.resource[0].supportedProfile[0].extension[1].url = $ExpExt
* rest.resource[0].supportedProfile[0].extension[1].valueCode = #SHOULD
* rest.resource[0].interaction[0].code = #create
* rest.resource[0].interaction[0].extension[0].url = $ExpExt
* rest.resource[0].interaction[0].extension[0].valueCode = #SHOULD
* rest.resource[0].interaction[0].code = #update
* rest.resource[0].interaction[0].extension[0].url = $ExpExt
* rest.resource[0].interaction[0].extension[0].valueCode = #SHOULD
// Location requirements
* rest.resource[0].type = #Location
* rest.resource[0].extension[0].url = $ExpExt
* rest.resource[0].extension[0].valueCode = #SHALL
* rest.resource[0].supportedProfile[0] = "http://hl7.org/fhir/us/saner/StructureDefinition/saner-resource-location"
* rest.resource[0].supportedProfile[0].extension[0].url = $ExpExt
* rest.resource[0].supportedProfile[0].extension[0].valueCode = #SHOULD
* rest.resource[0].interaction[0].code = #create
* rest.resource[0].interaction[0].extension[0].url = $ExpExt
* rest.resource[0].interaction[0].extension[0].valueCode = #SHOULD
* rest.resource[0].interaction[0].code = #update
* rest.resource[0].interaction[0].extension[0].url = $ExpExt
* rest.resource[0].interaction[0].extension[0].valueCode = #SHOULD
// QuestionnaireResponse requirements
* rest.resource[0].type = #QuestionnaireResponse
* rest.resource[0].extension[0].url = $ExpExt
* rest.resource[0].extension[0].valueCode = #SHALL
* rest.resource[0].supportedProfile[0] = "http://hl7.org/fhir/us/saner/StructureDefinition/SanerQuestionnaireResponse"
* rest.resource[0].supportedProfile[0].extension[0].url = $ExpExt
* rest.resource[0].supportedProfile[0].extension[0].valueCode = #SHALL
* rest.resource[0].interaction[0].code = #create
* rest.resource[0].interaction[0].extension[0].url = $ExpExt
* rest.resource[0].interaction[0].extension[0].valueCode = #SHALL
* rest.resource[0].interaction[0].code = #update
* rest.resource[0].interaction[0].extension[0].url = $ExpExt
* rest.resource[0].interaction[0].extension[0].valueCode = #SHALL

```

Parameterized RuleSets

```
Instance: TestCapabilityStatement3
InstanceOf: CapabilityStatement
* status = #active
* date = "2020-12-18"
* kind = #requirements
* fhirVersion = #4.0.1
* format[0] = #json
* rest.mode = #server
// MeasureReport requirements
* insert SupportResource(#MeasureReport, #SHALL)
* insert SupportProfile("http://hl7.org/fhir/us/saner/StructureDefinition/PublicHealthMeasureReport", #SHALL)
* insert SupportInteraction(#create, #SHALL)
* insert SupportInteraction(#update, #SHALL)
// Measure requirements
* insert SupportResource(#Measure, #SHALL)
* insert SupportProfile("http://hl7.org/fhir/us/saner/StructureDefinition/PublicHealthMeasure", #SHOULD)
* insert SupportProfile("http://hl7.org/fhir/us/saner/StructureDefinition/PublicHealthMeasureStratifier", #SHOULD)
* insert SupportInteraction(#create, #SHOULD)
* insert SupportInteraction(#update, #SHOULD)
// Location requirements
* insert SupportResource(#Location, #SHALL)
* insert SupportProfile("http://hl7.org/fhir/us/saner/StructureDefinition/saner-resource-location", #SHOULD)
* insert SupportInteraction(#create, #SHOULD)
* insert SupportInteraction(#update, #SHOULD)
// QuestionnaireResponse requirements
* insert SupportResource(#QuestionnaireResponse, #SHALL)
* insert SupportProfile("http://hl7.org/fhir/us/saner/StructureDefinition/SanerQuestionnaireResponse", #SHALL)
* insert SupportInteraction(#create, #SHAL)
* insert SupportInteraction(#update, #SHAL)
```



- Compact
 - Consistent
 - Easier to read
 - Easier to write
 - Fewer mistakes

Logical Models and Resources: Custom Content Structures

	Logical Models	Resources
Primary Use Case	Domain Analysis Models	Electronic Data Exchange
Recommended for	IG Authors	HL7 Work Groups
FHIR-conformant?	Yes	HL7 Resources Only
Supported by IG Publisher?	Yes	No
Allowed Parents	Logical Models, Complex Types	DomainResource, Resource
Default Parent (FSH)	Base (R5, backported to R4)	DomainResource

FSH Rules for Logical Models and Resources

- New Rule: AddElement Rule
- Familiar Rules: Binding, Cardinality, Flag, Insert, Obeys, and Type
 - Disallowed: Assignment and Contains (see [Interpretation of ElementDefinition in different contexts](#))
- Logical models and resources cannot constrain elements inherited from their parent

Logical Models: HIVRecord Example

```

Logical: HIVRecord
Id: HIVRecord
Parent: Element
Title: "HIV Longitudinal Record Logical Model"
Description: "This is the logical model for the shared record for an HIV patient."
* identifier          0..* Identifier           "Unique business identifiers for the record"
* patientIdentifier   0..* Identifier           "The patient's identifier"
* patientReference    0..1 Reference            "The patient (as a FHIR Reference)"
* testResults          0..* BackboneElement      "Patient's Test results"
  * results             0..1 SimpleQuantity       "The results of the patient's tests"
  * testDate            0..1 date                  "The date of the patient's test"
  * samplingDate        0..1 date                  "The date the samples were collected for the patient's current test"
* arvTreatment         0..* BackboneElement      "Antiretroviral treatment information"
  * courseOfTreatment   0..1 BackboneElement      "The current course of ARV treatment"
    * treatmentStartDate 0..1 date                  "The starting date of the current course of ARV treatment"
    * treatment_loss_signs 0..1 boolean             "Treatment loss signs"
    * treatment_loss_signs_date 0..1 date              "Treatment loss signs - date"
    * treatmentEndDate    0..1 date                  "The end date of the course of ARV treatment"
* co-infections        0..* BackboneElement      "Other infections reported for the patient"
  * prevention          0..1 boolean             "Whether the patient has any tuberculosis prevention activity"
  * diagnosis           0..1 BackboneElement      "The patient's concurrent diagnosis"
    * code                0..1 CodeableConcept     "The patient's concurrent diagnosis"
    * period              0..1 Period               "The onset for tuberculosis"
  * treatment            0..* CodeableReference    "The patient's treatments - should perhaps be a different parent element?"
* death                0..1 BackboneElement      "The death of the patient"
  * dateofDeath          0..1 date                  "The date of the patient's death"
  * causeofDeath         0..1 CodeableConcept     "The cause of the patient's death"

```

Yes, this does compile!

Name	Flags	Card.	Type	Description & Constraints
HIVRecord	0..*	Element		HIV case record
identifier	0..*	Identifier		Unique business identifiers for the record
patientIdentifier	0..*	Identifier		The patient's identifier
patientReference	0..1	Reference()		The patient (as a FHIR Reference)
testResults	0..*	BackboneElement		Patient's Test results
results	0..1	SimpleQuantity		The results of the patient's tests
testDate	0..1	date		The date of the patient's test
samplingDate	0..1	date		The date the samples were collected for the patient's current test
arvTreatment	0..*	BackboneElement		Antiretroviral treatment information
courseOfTreatment	0..1	BackboneElement		The current course of ARV treatment
treatmentStartDate	0..1	date		The starting date of the current course of ARV treatment
treatment_loss_signs	0..1	boolean		Treatment loss signs
treatment_loss_signs_date	0..1	date		Treatment loss signs - date
treatmentEndDate	0..1	date		The end date of the course of ARV treatment if the current treatment is ended
co-infections	0..*	BackboneElement		Other infections reported for the patient
prevention	0..1	boolean		Whether the patient has any tuberculosis prevention activity
diagnosis	0..1	BackboneElement		The patient's concurrent diagnosis
code	0..1	CodeableConcept		The patient's concurrent diagnosis
period	0..1	Period		The onset for tuberculosis
treatment	0..*	CodeableReference()		The patient's treatments - should perhaps be a different parent element?
death	0..1	BackboneElement		The death of the patient
dateofDeath	0..1	date		The date of the patient's death
causeofDeath	0..1	CodeableConcept		The cause of the patient's death

Adapted from: <http://build.fhir.org/ig/openhie/hiv-ig/branches/master/StructureDefinition-model-hiv-record.html>

Logical Models and Resources: AddElement Rule

* <element> {min}..{max} {flags} {datatype} "{short}" "{definition}"

```
* email 0..* string "The person's email addresses"
```

```
* preferredName[x] 0..1 SU string or HumanName "The person's preferred name" ""
```

Sometimes patients prefer to be called by a name other than their _formal_ name. This may be:

- * their nick name
- * their maiden name
- * etc.

""

```
* serviceAnimal 0..* BackboneElement "Service animals" "Animals trained to assist the person by performing certain tasks."
```

```
* serviceAnimal.name 0..1 string "Name of service animal" "The name by which the service animal responds."
```

```
* serviceAnimal.breed 1..* CodeableConcept "Breed of service animal" "The dominant breed or breeds of the service animal."
```

```
* serviceAnimal.startDate 0..1 date "Date the service animal began work" "When the service animal began working for the person."
```

Looks familiar, right? Well... almost. *Can you spot the difference?*

Name	Flags	Card.	Type	Description & Constraints
Patient	N		DomainResource	Information about an individual or animal receiving health care services Elements defined in Ancestors: id, meta, implicitRules, language, text, contained, extension, modifierExtension
identifier	Σ	0..*	Identifier	An identifier for this patient
active	?! Σ	0..1	boolean	Whether this patient's record is in active use

FSH STU1 Path Syntax: The ~~Problem~~ Annoyance

Nested elements require redundant paths and result in high text density

```
Logical: HIVRecord
Id: HIVRecord
Parent: Element
Title: "HIV Longitudinal Record Logical Model"
Description: "This is the logical model for the shared record for an HIV patient."
* identifier 0...* Identifier "Unique business identifiers for the record"
* patientIdentifier 0...* Identifier "The patient's identifier"
* patientReference 0..1 Reference "The patient (as a FHIR Reference)"
* testResults 0...* BackboneElement "Patient's Test results"
* testResults.results 0..1 SimpleQuantity "The results of the patient's tests"
* testResults.testDate 0..1 date "The date of the patient's test"
* testResults.samplingDate 0..1 date "The date the samples were collected for the patient's current test"
* arvTreatment 0...* BackboneElement "Antiretroviral treatment information"
* arvTreatment.courseOfTreatment 0..1 BackboneElement "The current course of ARV treatment"
* arvTreatment.courseOfTreatment.treatmentStartDate 0..1 date "The starting date of the current course of ARV treatment"
* arvTreatment.courseOfTreatment.treatment_loss_signs 0..1 boolean "Treatment loss signs"
* arvTreatment.courseOfTreatment.treatment_loss_signs_date 0..1 date "Treatment loss signs - date"
* arvTreatment.courseOfTreatment.treatmentEndDate 0..1 date "The end date of the course of ARV treatment if the current treatment ended"
* co-infections 0...* BackboneElement "Other infections reported for the patient"
* co-infections.prevention 0..1 boolean "Whether the patient has any tuberculosis prevention activity"
* co-infections.diagnosis 0..1 BackboneElement "The patient's concurrent diagnosis"
* co-infections.diagnosis.code 0..1 CodeableConcept "The patient's concurrent diagnosis"
* co-infections.diagnosis.period 0..1 Period "The onset for tuberculosis"
* co-infections.treatment 0...* CodeableReference "The patient's treatments - should perhaps be a different parent element?"
* death 0..1 BackboneElement "The death of the patient"
* death.dateofDeath 0..1 date "The date of the patient's death"
* death.causeofDeath 0..1 CodeableConcept "The cause of the patient's death"
```



Adapted from: <http://build.fhir.org/ig/openhie/hiv-ig/branches/master/StructureDefinition-model-hiv-record.html>

Indent Rules: A Sensible Way to Represent Path Structure

Indent two spaces to prepend the previous less-indented rule's path

```

Logical: HIVRecord
Id: HIVRecord
Parent: Element
Title: "HIV Longitudinal Record Logical Model"
Description: "This is the logical model for the shared record for an HIV patient."
* identifier 0..* Identifier "Unique business identifiers for the record"
* patientIdentifier 0..* Identifier "The patient's identifier"
* patientReference 0..1 Reference "The patient (as a FHIR Reference)"
* testResults 0..* BackboneElement "Patient's Test results"
  * results 0..1 SimpleQuantity "The results of the patient's tests"
  * testDate 0..1 date "The date of the patient's test"
  * samplingDate 0..1 date "The date the samples were collected for the patient's current test"
* arvTreatment 0..* BackboneElement "Antiretroviral treatment information"
  * courseOfTreatment 0..1 BackboneElement "The current course of ARV treatment"
    * treatmentStartDate 0..1 date "The starting date of the current course of ARV treatment"
    * treatment_loss_signs 0..1 boolean "Treatment loss signs"
    * treatment_loss_signs_date 0..1 date "Treatment loss signs - date"
    * treatmentEndDate 0..1 date "The end date of the course of ARV treatment if the current treatment ended"
* co-infections 0..* BackboneElement "Other infections reported for the patient"
  * prevention 0..1 boolean "Whether the patient has any tuberculosis prevention activity"
  * diagnosis 0..1 BackboneElement "The patient's concurrent diagnosis"
    * code 0..1 CodeableConcept "The patient's concurrent diagnosis"
    * period 0..1 Period "The onset for tuberculosis"
  * treatment 0..* CodeableReference "The patient's treatments - should perhaps be a different parent element?"
* death 0..1 BackboneElement "The death of the patient"
  * dateofDeath 0..1 date "The date of the patient's death"
  * causeofDeath 0..1 CodeableConcept "The cause of the patient's death"

```

Indent rules work in:

- Profiles
- Extensions
- Logical Models
- Resources
- Mappings
- Instances
- Code Systems (*stay tuned*)

With:

- Path-based rules
- New “path rule”
- Concept rules (*stay tuned*)

Adapted from: <http://build.fhir.org/ig/openhie/hiv-ig/branches/master/StructureDefinition-model-hiv-record.html>

Example Custom Resource and Instance: EmergencyVehicle

```

Resource:      EmergencyVehicle
Title:         "Emergency Vehicle"
Description:   "An emergency vehicle, such as an ambulance or fire truck."
* identifier 0..* SU Identifier
  "Identifier(s) of the vehicle"
  "Vehicle identifiers may include VINs and serial numbers."
* make 0..1 SU Coding
  "The vehicle make"
  "The vehicle make, e.g., Chevrolet."
* make from EmergencyVehicleMake (extensible)
* model 0..1 SU Coding
  "The vehicle model"
  "The vehicle model, e.g., G4500."
* model from EmergencyVehicleModel (extensible)
* year 0..1 SU positiveInt
  "Year of manufacture"
  "The year the vehicle was manufactured"
* servicePeriod 0..1 Period
  "When the vehicle was in service"
  "Start date and end date (if applicable) when the vehicle operated."
* operator 0..* Reference(Organization or Practitioner or PractitionerRole)
  "The operator"
  "The organization or persons responsible for operating the vehicle"
* device 0..* Reference(Device)
  "Devices on board"
  "Devices on board the vehicle."

```

```
{
  "resourceType": "EmergencyVehicle",
  "id": "Vehicle258",
  "identifier": [
    {
      "value": "258",
      "system": "http://acme.org/vehicle/identifiers"
    }
  ],
  "make": {
    "code": "Chevrolet",
    "system": "http://devdays.com/fsh/CodeSystem/EVMake"
  },
  "model": {
    "code": "G4500",
    "system": "http://devdays.com/fsh/CodeSystem/EVModel"
  },
  "year": 2018,
  "servicePeriod": {
    "start": "2018-08-12"
  },
  "operator": [
    {
      "reference": "Organization/82793"
    }
  ],
  "device": [
    {
      "reference": "Device/89042537"
    },
    {
      "reference": "Device/23490853"
    },
    {
      "reference": "Device/58972589"
    }
  ]
}
```

Defining Code Systems in STU1

Defining URL:	urn:oid:2.16.840.1.113883.6.238
Version:	3.1.1
Name:	RaceAndEthnicityCDC
Title:	Race & Ethnicity - CDC
Status:	Active
Content:	All the concepts defined by the code system are included in the code system resource
Definition:	The U.S. Centers for Disease Control and Prevention (CDC) has prepared a code set for use in coding race and ethnicity data. This code set is based on current federal standards for classifying data on race and ethnicity, specifically the minimum race and ethnicity categories defined by the U.S. Office of Management and Budget (OMB) and a more detailed set of race and ethnicity categories maintained by the U.S. Bureau of the Census (BC). The main purpose of the code set is to facilitate use of federal standards for classifying data on race and ethnicity when these data are exchanged, stored, retrieved, or analyzed in electronic form. At the same time, the code set can be applied to paper-based records systems to the extent that these systems are used to collect, maintain, and report data on race and ethnicity in accordance with current federal standards. Source: Race and Ethnicity Code Set Version 1.0 .
Publisher:	HL7 US Realm Steering Committee
Content Mode:	Complete
Source Resource:	XML / JSON / Turtle

Properties

Code	URL	Description	Type
abstract		True if an element is considered 'abstract' - in other words, the code is not for use as a real concept	boolean

This code system urn:oid:2.16.840.1.113883.6.238 defines the following codes:

Lvl	Code	Display	Definition
1	1000-9	Race	Race, Note that this is an abstract 'grouping' concept and not for use as a real concept
2	1002-5	American Indian or Alaska Native	American Indian or Alaska Native
3	1004-1	American Indian	American Indian
3	1735-0	Alaska Native	Alaska Native
3	1006-6	Abenaki	Abenaki
3	1008-2	Algonquian	Algonquian
3	1010-8	Apache	Apache
3	1021-5	Arapaho	Arapaho
3	1026-4	Arikara	Arikara
3	1028-0	Assiniboine	Assiniboine

<http://www.hl7.org/fhir/us/core/CodeSystem-cdcrec.html>

Top-level metadata SUPPORTED

Code systems with hierarchical codes and/or code-specific metadata (property, designation) must be defined as FSH Instances

```
Instance: cdcrec
InstanceOf: CodeSystem
Usage: #definition
* url = "urn:oid:2.16.840.1.113883.6.238"
* version = "3.1.1"
* name = "RaceAndEthnicityCDC"
* title = "Race & Ethnicity - CDC"
* status = #active
* publisher = "HL7 US Realm Steering Committee"
* description = "The U.S. Centers for Disease Control and Prevention (CDC) has prepared a code set for use in coding race and ethnicity data. This code set is based on current federal standards for classifying data on race and ethnicity, specifically the minimum race and ethnicity categories defined by the U.S. Office of Management and Budget (OMB) and a more detailed set of race and ethnicity categories maintained by the U.S. Bureau of the Census (BC). The main purpose of the code set is to facilitate use of federal standards for classifying data on race and ethnicity when these data are exchanged, stored, retrieved, or analyzed in electronic form. At the same time, the code set can be applied to paper-based records systems to the extent that these systems are used to collect, maintain, and report data on race and ethnicity in accordance with current federal standards. Source: Race and Ethnicity Code Set Version 1.0."
* hierarchyMeaning = #is-a
* content = #complete
* property.code = #abstract
* property.description = "True if an element is considered 'abstract' - in other words, the code is not for use as a real concept"
* property.type = #boolean
* concept[0].code = #1000-9
* concept[=].display = "Race"
* concept[=].definition = "Race, Note that this is an abstract 'grouping' concept and not for use as a real concept"
* concept[=].property.code = #abstract
* concept[=].property.valueBoolean = true
* concept[=].concept[0].code = #1002-5
* concept[=].concept[=].display = "American Indian or Alaska Native"
* concept[=].concept[=].definition = "American Indian or Alaska Native"
* concept[=].concept[=].concept[0].code = #1004-1
* concept[=].concept[=].concept[=].display = "American Indian"
* concept[=].concept[=].concept[=].definition = "American Indian"
* concept[=].concept[=].concept[=].code = #1735-0
* concept[=].concept[=].concept[=].display = "Alaska Native"
* concept[=].concept[=].concept[=].definition = "Alaska Native"
* concept[=].concept[=].concept[+].code = #1006-6
* concept[=].concept[=].concept[=].display = "Abenaki"
* concept[=].concept[=].concept[=].definition = "Abenaki"
* concept[=].concept[=].concept[=].code = #1008-2
* concept[=].concept[=].concept[=].display = "Algonquian"
* concept[=].concept[=].concept[=].definition = "Algonquian"
* concept[=].concept[=].concept[+].code = #1010-8
* concept[=].concept[=].concept[=].display = "Apache"
* concept[=].concept[=].concept[=].definition = "Apache"
* concept[=].concept[=].concept[=].code = #1021-5
* concept[=].concept[=].concept[=].display = "Arapaho"
* concept[=].concept[=].concept[=].definition = "Arapaho"
* concept[=].concept[=].concept[+].code = #1026-4
* concept[=].concept[=].concept[=].display = "Arikara"
* concept[=].concept[=].concept[=].definition = "Arikara"
* concept[=].concept[=].concept[=].code = #1028-0
* concept[=].concept[=].concept[=].display = "Assiniboine"
* concept[=].concept[=].concept[=].definition = "Assiniboine"
```

Property definition SUPPORTED

Property use NOT SUPPORTED

Hierarchical codes NOT SUPPORTED

Defining Code Systems in FSH STU2

Top-level metadata

SUPPORTED

Property Definition

SUPPORTED

Property Use

SUPPORTED

Hierarchical codes

SUPPORTED

Concept caret rule

Concept hierarchy

```
CodeSystem: RaceAndEthnicityCDC
Id: cdcrc
Title: "Race & Ethnicity - CDC"
* ^hierarchyMeaning = #is-a
* ^property[0].code = #abstract
* ^property[=].type = #boolean
* ^property[=].description = "True if an element is considered 'abstract' - in other words, the code is not for use..."
* #1000-9 "Race" "Race, Note that this is an abstract 'grouping' concept and not for use as a real..."
* #1000-9 ^property.code = #abstract
* #1000-9 ^property.valueBoolean = true
* #1000-9 #1002-5 "American Indian or Alaska Native" "American Indian or Alaska Native"
* #1000-9 #1002-5 #1004-1 "American Indian" "American Indian"
* #1000-9 #1002-5 #1735-0 "Alaska Native" "Alaska Native"
// ...
* #1000-9 #2028-9 "Asian" "Asian"
* #1000-9 #2028-9 #2029-7 "Asian Indian" "Asian Indian"
* #1000-9 #2028-9 #2030-5 "Bangladeshi" "Bangladeshi"
// ...
* #1000-9 #2131-1 "Other Race" "Note that this term remains in the table for completeness, even though..."
* #2133-7 "Ethnicity" "Ethnicity Note that this is an abstract 'grouping' concept and not for use as a real..."
* #2133-7 ^property.code = #abstract
* #2133-7 ^property.valueBoolean = true
* #2133-7 #2135-2 "Hispanic or Latino" "Hispanic or Latino"
* #2133-7 #2135-2 #2137-8 "Spaniard" "Spaniard"
* #2133-7 #2135-2 #2148-5 "Mexican" "Mexican"
// ...
* #2133-7 #2186-5 "Not Hispanic or Latino" "Note that this term remains in the table for completeness, even though..."
```

Adapted from <http://www.hl7.org/fhir/us/core/CodeSystem-cdcrc.html>

Defining Code Systems in FSH STU2: Indent Paths

Top-level metadata

SUPPORTED

Property Definition

SUPPORTED

Property Use

SUPPORTED

Hierarchical codes

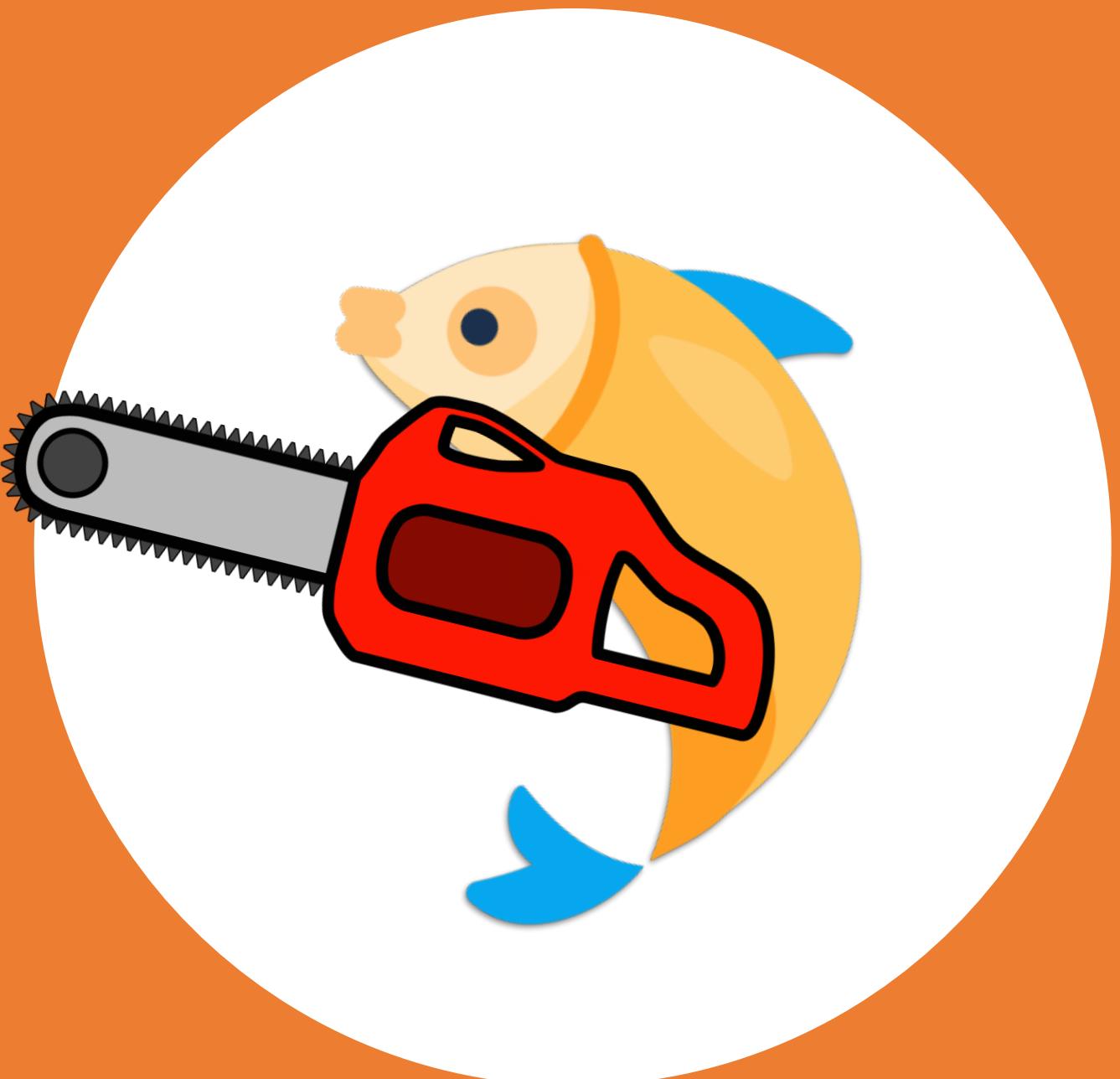
SUPPORTED

Concept caret rule

3rd level code

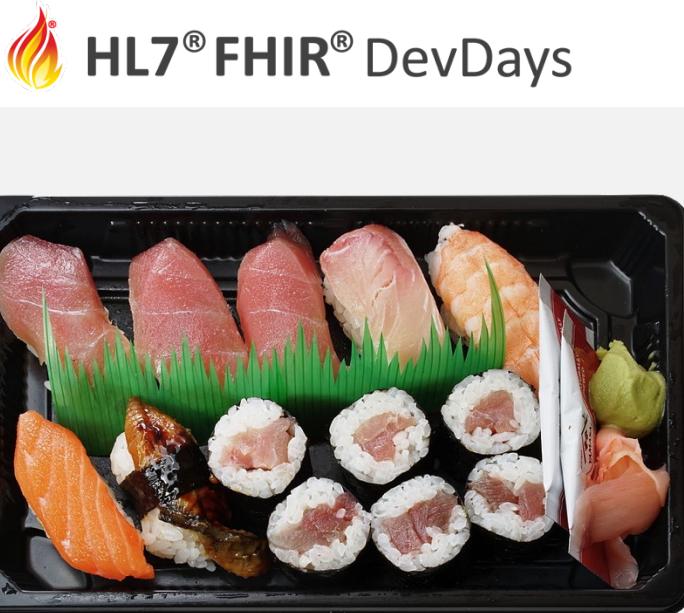
```
CodeSystem: RaceAndEthnicityCDC
Id: cdcrc
Title: "Race & Ethnicity - CDC"
* ^hierarchyMeaning = #is-a
* ^property[0].code = #abstract
* ^property[=].type = #boolean
* ^property[=].description = "True if an element is considered 'abstract' - in other words, the code is not for use..."
* #1000-9 "Race" "Race, Note that this is an abstract 'grouping' concept and not for use as a real..."
* ^property.code = #abstract
* ^property.valueBoolean = true
* #1002-5 "American Indian or Alaska Native" "American Indian or Alaska Native"
* #1004-1 "American Indian" "American Indian"
* #1735-0 "Alaska Native" "Alaska Native"
// ...
* #2028-9 "Asian" "Asian"
* #2029-7 "Asian Indian" "Asian Indian"
* #2030-5 "Bangladeshi" "Bangladeshi"
// ...
* #2131-1 "Other Race" "Note that this term remains in the table for completeness, even though..."
* #2133-7 "Ethnicity" "Ethnicity Note that this is an abstract 'grouping' concept and not for use as a real..."
* ^property.code = #abstract
* ^property.valueBoolean = true
* #2135-2 "Hispanic or Latino" "Hispanic or Latino"
* #2137-8 "Spaniard" "Spaniard"
* #2148-5 "Mexican" "Mexican"
// ...
* #2186-5 "Not Hispanic or Latino" "Note that this term remains in the table for completeness, even though..."
```

Adapted from <http://www.hl7.org/fhir/us/core/CodeSystem-cdcrc.html>



FSH Tools

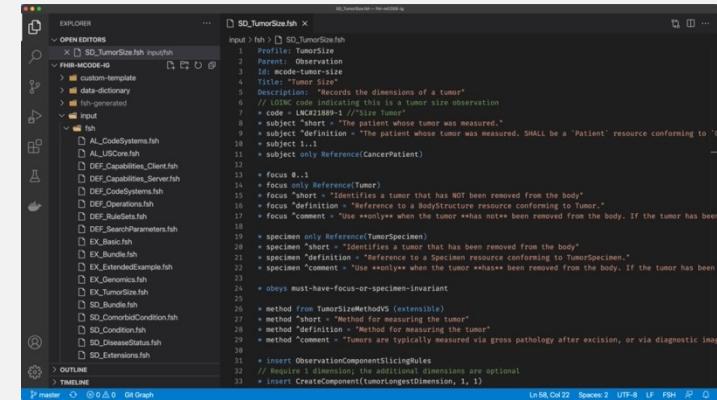




SUSHI



GoFSH



VS Code Extension

FSH Online

FSH Finder

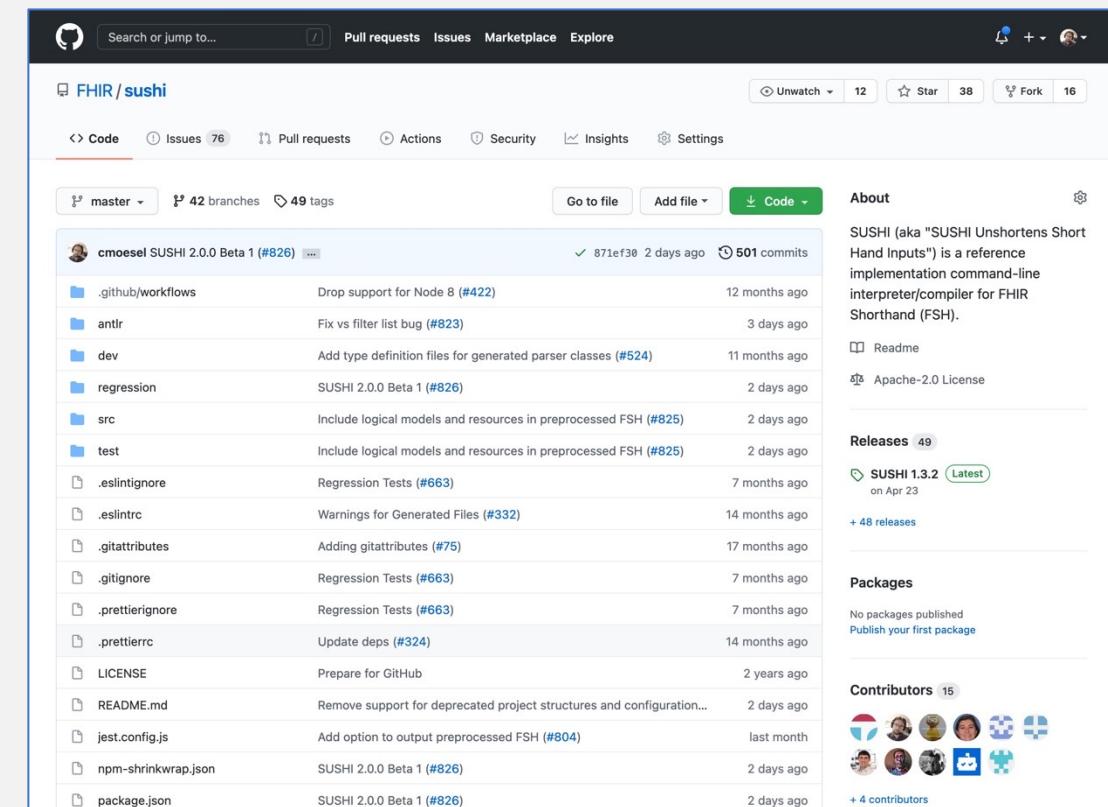
The image shows the homepage of FSH School. At the top, there's a navigation bar with links for 'Quick Start', 'Documentation', 'Community', 'Downloads', 'Migration', and a search bar. The main title 'Welcome to FSH School' is centered above a call-to-action button labeled 'Get Started'. Below this, there are three buttons: 'Quick Start', 'Read the Docs', and 'Who's on Board?'. A large, stylized illustration of a school of fish swimming towards the right is the background. One fish in the lead is wearing a graduation cap, symbolizing learning. The overall theme is educational and professional development.

FSH School

SUSHI: SUSHI Unshortens Shorthand Inputs

New! SUSHI 2.0.0-beta.1

- Logical Models & Resources
- Indent Paths
- Concept Hierarchy & Caret Rules
- Preprocessed FSH Output
- *Breaking Changes*
 - Space before * is now meaningful
 - Deprecated syntax not supported
 - Legacy project format not supported



<https://github.com/FHIR/sushi>

Install SUSHI Beta: `npm install -g fsh-sushi@2.0.0-beta.1`

SUSHI 2.0.0: Preprocessed FSH Output

sushi -p myproject

FSH in /input/fsh

```

Alias: CAT = http://hl7.org/fhir/ValueSet/observation-category

Profile: ObservationProfile
Parent: Observation
* insert Metadata
* category from CAT (required)

RuleSet: Metadata
* ^version = "1.2.3"
* ^publisher = "Example publisher"

Instance: PatientInstance
InstanceOf: Patient
* name
  * given[+] = "John"
  * given[+] = "Q"
  * family = "Patient"

```

Resolved alias

Preprocessed FSH in /_preprocessed

```

Alias: CAT = http://hl7.org/fhir/ValueSet/observation-category

// Originally defined on lines 3 - 6
Profile: ObservationProfile
Parent: Observation
Id: ObservationProfile
* ^version = "1.2.3"
* ^publisher = "Example publisher"
* category from http://hl7.org/fhir/ValueSet/observation-category (required)

// Originally defined on lines 12 - 17
Instance: PatientInstance
InstanceOf: Patient
Usage: #example
* name.given[0] = "John"
* name.given[1] = "Q"
* name.family = "Patient"

```

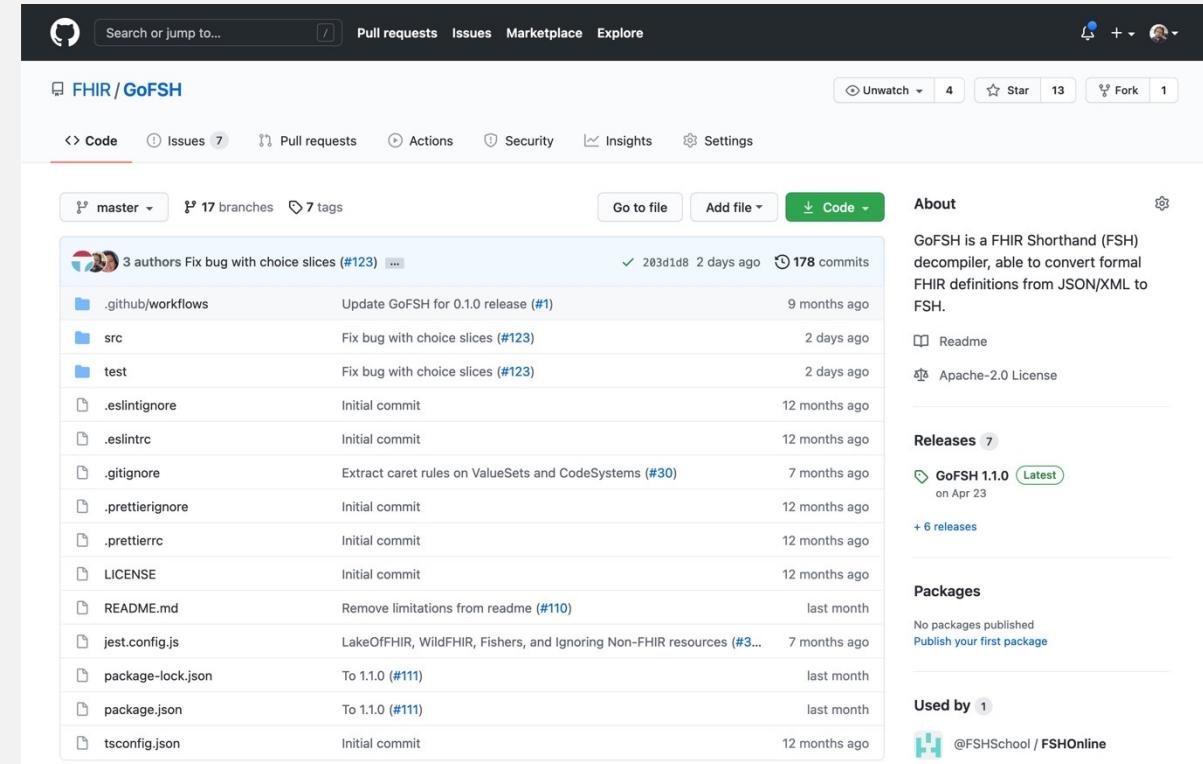
Expanded paths

Explicit indices

GoFSh: Converts FHIR JSON/XML to FSH

GoFSh 1.x (Current Release)

- Command line interface
- Converts FHIR JSON/XML to FSH
- Multiple output formats
- Supports FSH STU1, plus
 - Soft Indexing
- Development *in progress* for:
 - Logical Models & Resources
 - Hierarchical CodeSystems
 - Concept Caret Rules
 - Indent Paths



<https://github.com/FHIR/GoFSh>

Install: `npm install -g gofsh`

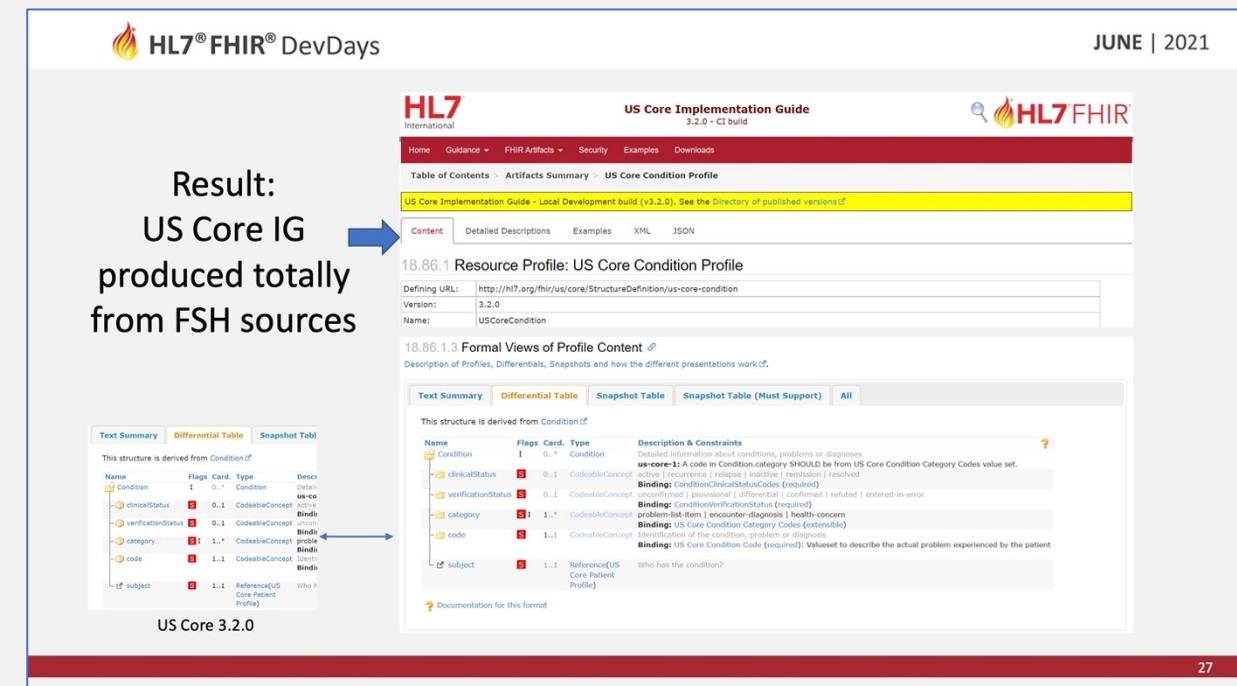
GoFSH: Converting US Core IG to FSH

Sound exciting? Check out:

Let's Build: Create an Implementation Guide with FHIR Shorthand
 June 8 @ 4:15pm (time travel required)

Spoiler Alert! 

Result:
 US Core IG
 produced totally
 from FSH sources



The screenshot displays the HL7 FHIR DevDays interface for the US Core Implementation Guide (3.2.0 - CI build). The URL is <http://hl7.org/fhir/us/core/StructureDefinition/us-core-condition>. The page shows the 'Content' tab selected, displaying the '18.86.1 Resource Profile: US Core Condition Profile'. Below this, the '18.86.1.3 Formal Views of Profile Content' section is shown. A large blue arrow points from the 'Result' text above to the screenshot.

Text Summary

Name	Flags	Card.	Type	Description
Condition	I	0..*	Condition	Condition
clinicalStatus	S	0..1	CodableConcept	Active
verificationStatus	S	0..1	CodableConcept	Unknown
category	I	1..*	CodableConcept	
code	S	1..1	CodableConcept	Bind1
subject	S	1..1	Reference<US Core Patient Profile>	Who is affected

US Core 3.2.0

US Core Implementation Guide - Local Development build (v3.2.0) - See the [Directory of published versions](#)

Content **Detailed Descriptions** **Examples** **XML** **JSON**

18.86.1 Resource Profile: US Core Condition Profile

Defining URL: <http://hl7.org/fhir/us/core/StructureDefinition/us-core-condition>
 Version: 3.2.0
 Name: USCoreCondition

18.86.1.3 Formal Views of Profile Content

This structure is derived from Condition¹

Name	Flags	Card.	Type	Description & Constraints
Condition	I	0..*	Condition	Detailed information about conditions, problems or diagnoses
clinicalStatus	S	0..1	CodableConcept	us-core-1: A code in Condition.category SHOULD be from US Core Condition Category Codes value set. Detailed information about conditions, problems or diagnoses
verificationStatus	S	0..1	CodableConcept	unconfirmed provisional differential confirmed refuted entered-in-error
category	I	1..*	CodableConcept	ConditionVerificationStatusCodes (extensible)
code	S	1..1	CodableConcept	Identification of the condition, problem or diagnosis
subject	S	1..1	Reference<US Core Patient Profile>	Documentation for this format

Who has the condition?

27

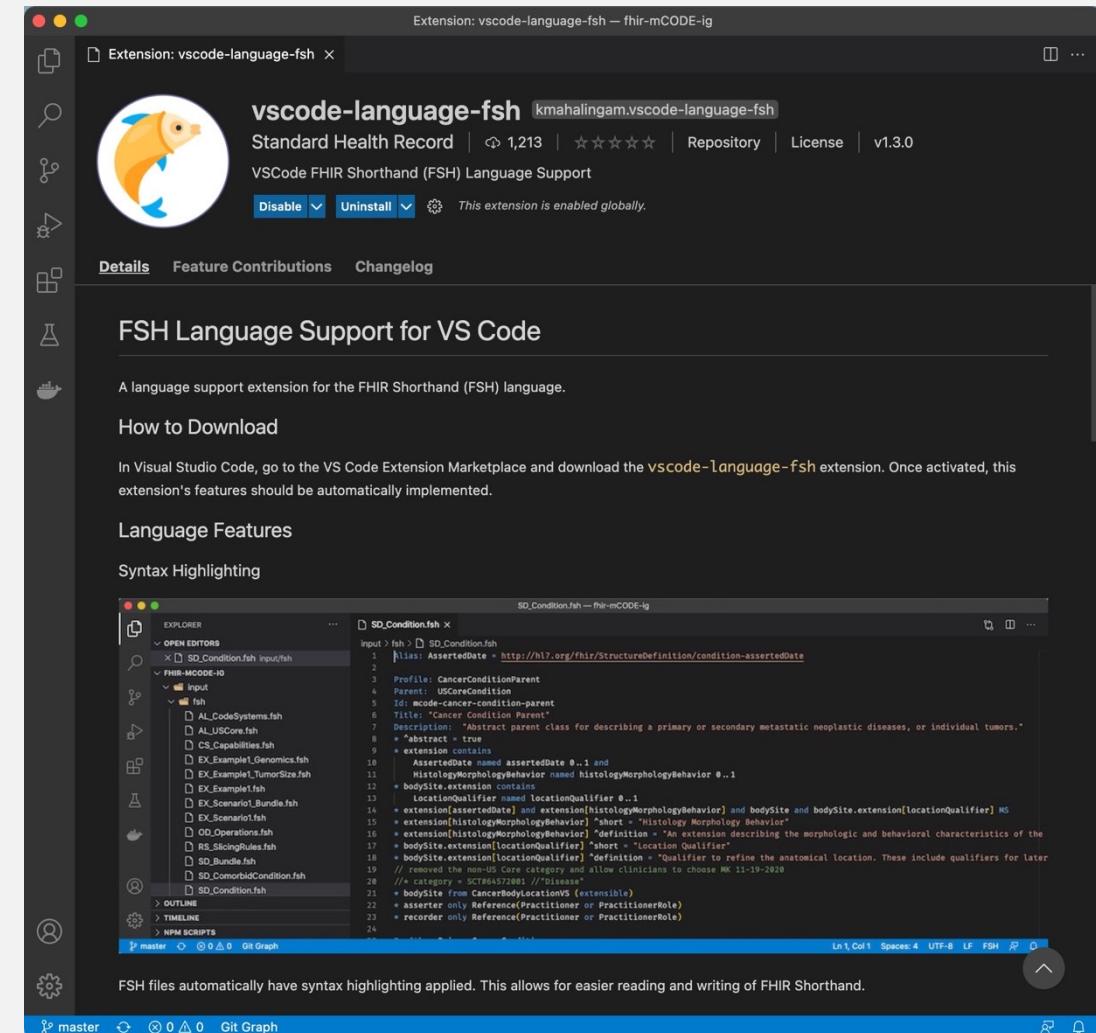
VS Code Extension: vscode-language-fsh

VS Code FSH Extension

- Visual Studio Code Editor
- Syntax highlighting
- Snippets
- Go to definition
- Open FHIR documentation

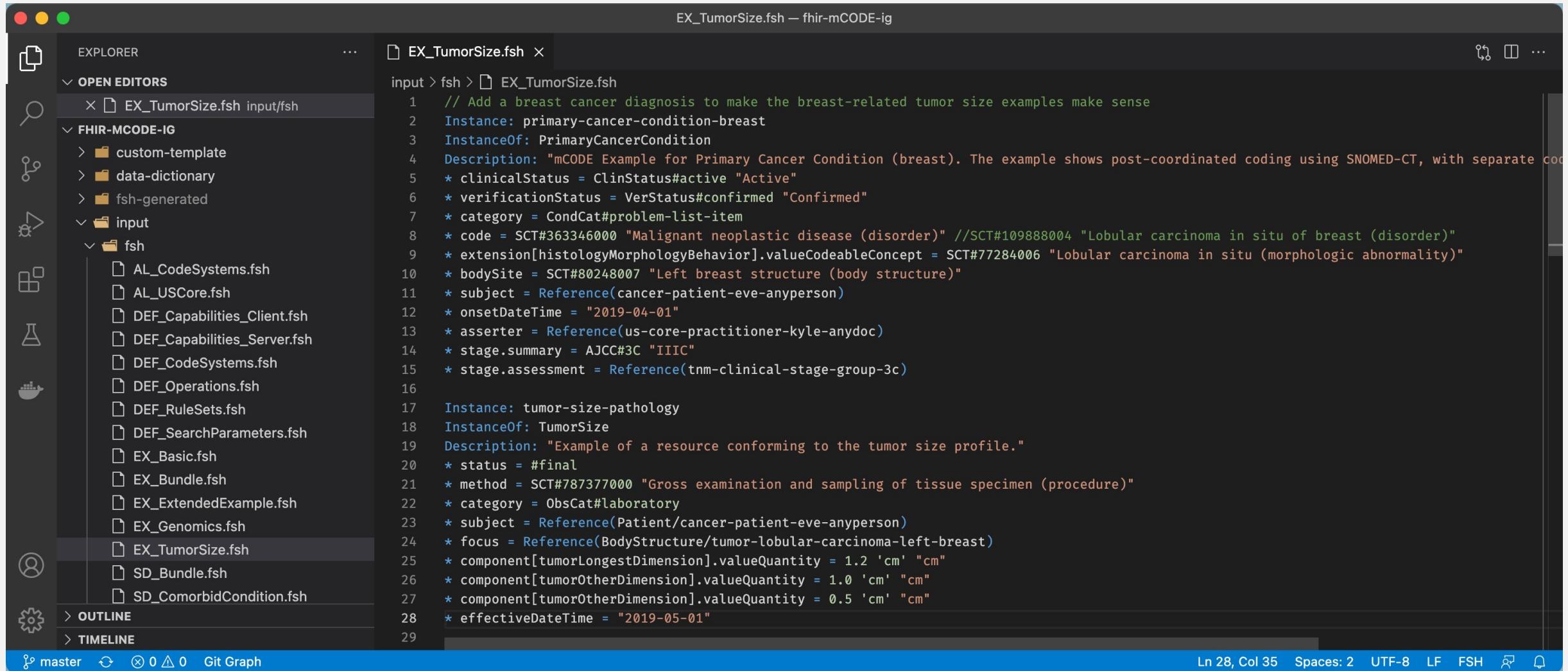
Install:

- Open a .fsh file in VS Code, or
- Search “FSH” in marketplace
- Go to: <https://bit.ly/3fUslk7>



VS Code Extension: Syntax Highlighting

EX_TumorSize.fsh — fhir-mCODE-ig



```

input > fsh > EX_TumorSize.fsh
1 // Add a breast cancer diagnosis to make the breast-related tumor size examples make sense
2 Instance: primary-cancer-condition-breast
3 InstanceOf: PrimaryCancerCondition
4 Description: "mCODE Example for Primary Cancer Condition (breast). The example shows post-coordinated coding using SNOMED-CT, with separate cod
5 * clinicalStatus = ClinStatus#active "Active"
6 * verificationStatus = VerStatus#confirmed "Confirmed"
7 * category = CondCat#problem-list-item
8 * code = SCT#363346000 "Malignant neoplastic disease (disorder)" //SCT#109888004 "Lobular carcinoma in situ of breast (disorder)"
9 * extension[histologyMorphologyBehavior].valueCodeableConcept = SCT#77284006 "Lobular carcinoma in situ (morphologic abnormality)"
10 * bodySite = SCT#80248007 "Left breast structure (body structure)"
11 * subject = Reference(cancer-patient-eve-anyperson)
12 * onsetDateTime = "2019-04-01"
13 * asserter = Reference(us-core-practitioner-kyle-anydoc)
14 * stage.summary = AJCC#3C "IIIC"
15 * stage.assessment = Reference(tnm-clinical-stage-group-3c)
16
17 Instance: tumor-size-pathology
18 InstanceOf: TumorSize
19 Description: "Example of a resource conforming to the tumor size profile."
20 * status = #final
21 * method = SCT#787377000 "Gross examination and sampling of tissue specimen (procedure)"
22 * category = ObsCat#laboratory
23 * subject = Reference(Patient/cancer-patient-eve-anyperson)
24 * focus = Reference(BodyStructure/tumor-lobular-carcinoma-left-breast)
25 * component[tumorLongestDimension].valueQuantity = 1.2 'cm' "cm"
26 * component[tumorOtherDimension].valueQuantity = 1.0 'cm' "cm"
27 * component[tumorOtherDimension].valueQuantity = 0.5 'cm' "cm"
28 * effectiveDateTime = "2019-05-01"
29

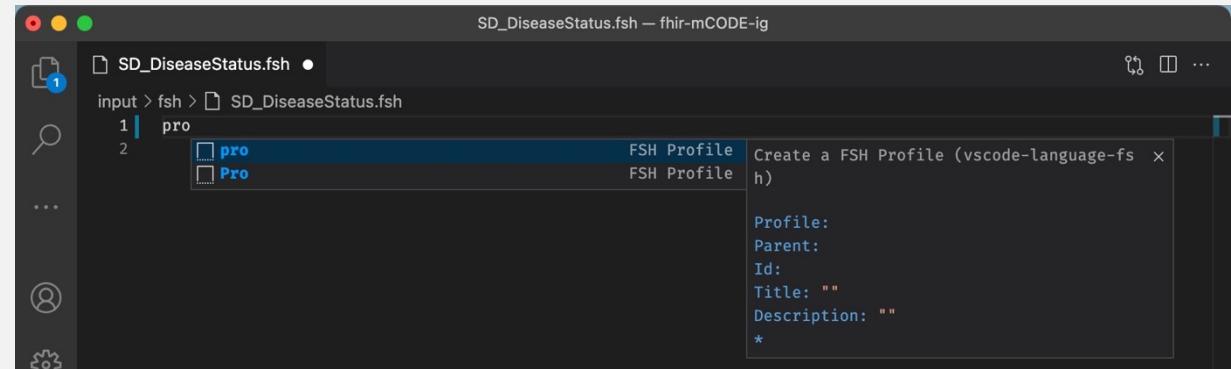
```

master ⌂ 0 △ 0 Git Graph Ln 28, Col 35 Spaces: 2 UTF-8 LF FSH ⌂ ⌂

VS Code Extension: Snippets

1. Type a FSH trigger phrase*

Trigger	FSH Item	Keywords
pro	Profile	Profile, Parent, Id (auto), Title (auto), Description
ext	Extension	Extension, Id (auto), Title (auto), Description
vs	ValueSet	ValueSet, Id (auto), Title (auto), Description
cs	CodeSystem	CodeSystem, Id (auto), Title (auto), Description
inst	Instance	Instance, InstanceOf, Usage (choice), Title (auto), Description

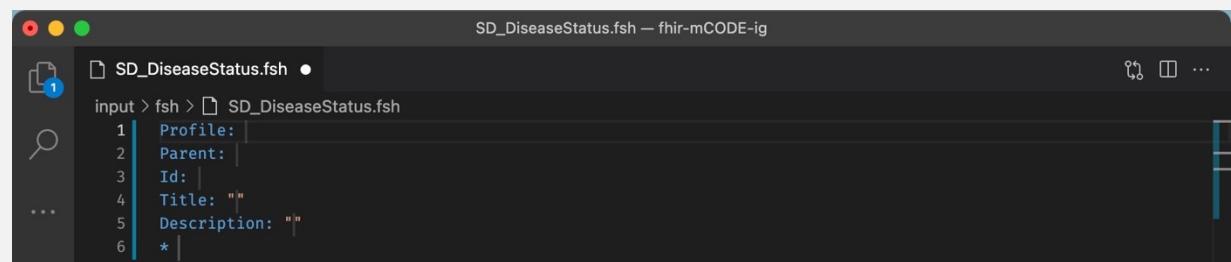


The screenshot shows the VS Code interface with a dark theme. A code editor window titled "SD_DiseaseStatus.fsh — fhir-mCODE-ig" is open. In the top right corner of the editor, there is a snippet suggestion box. The suggestion box has a title "Create a FSH Profile (vscode-language-fs x h)". It contains the following placeholder text:

```
Profile:  
Parent:  
Id:  
Title: ""  
Description: ""  
*
```

2. Hit <Enter> or <TAB> to start

- Use <TAB> to visit placeholders
- Bonus: Automatic id and title

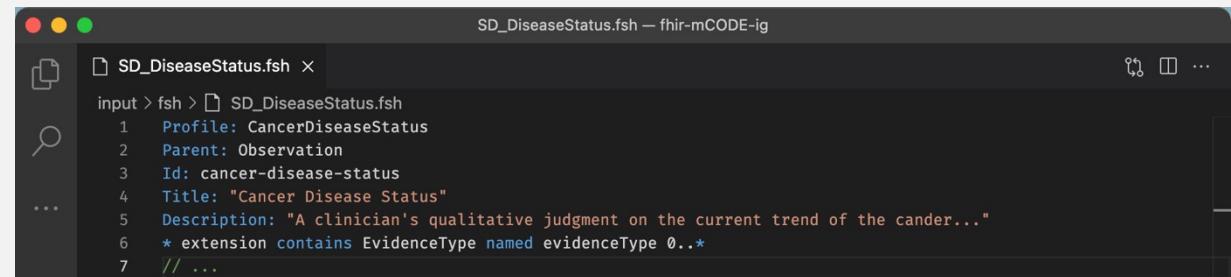


The screenshot shows the same code editor window. The placeholder text from the previous screenshot has been replaced by actual FSH code. The cursor is at the end of the last line.

```
Profile:  
Parent:  
Id:  
Title: ""  
Description: ""  
*
```

3. Start writing your rules

* Logical / Resource to be added soon.

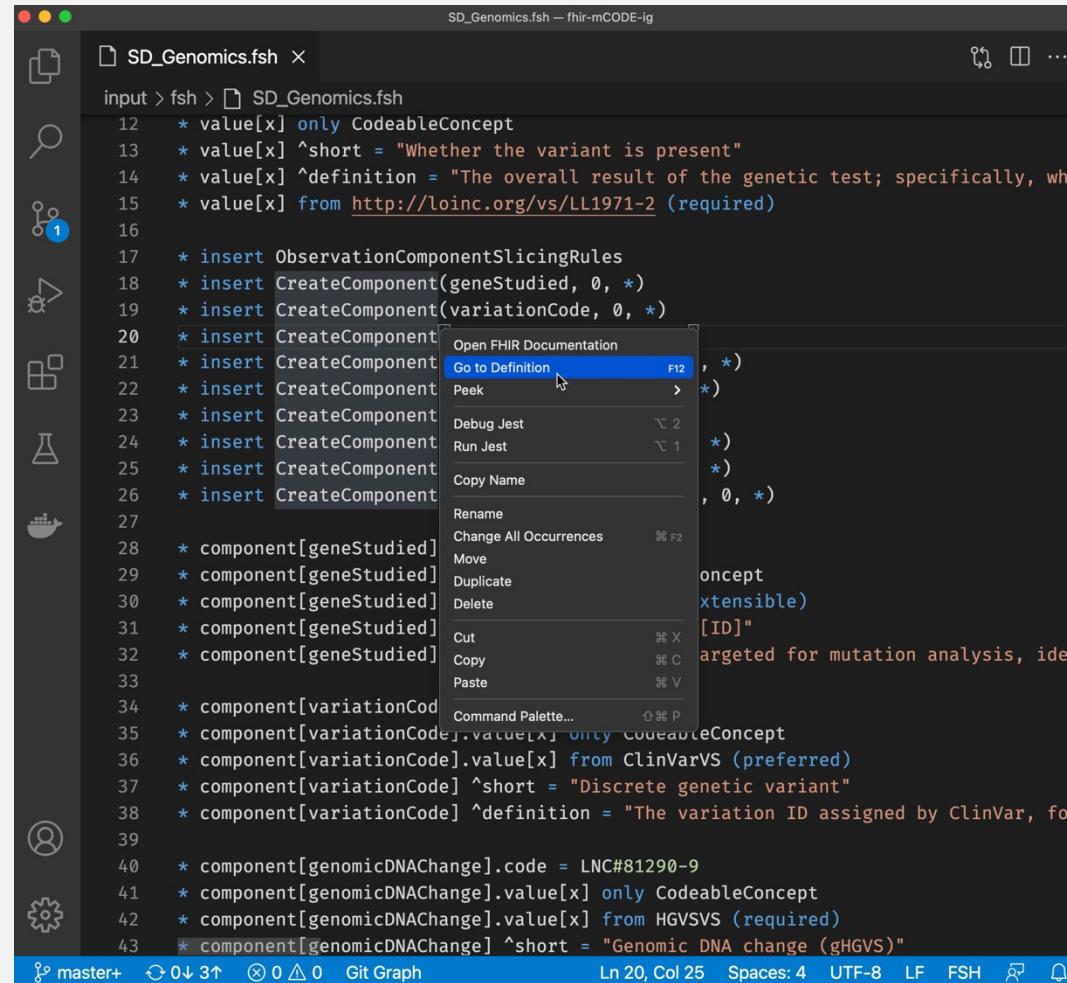


The screenshot shows the completed FSH profile definition. The code includes automatic generation of an ID and title, and a detailed description.

```
Profile: CancerDiseaseStatus  
Parent: Observation  
Id: cancer-disease-status  
Title: "Cancer Disease Status"  
Description: "A clinician's qualitative judgment on the current trend of the cancer..."  
* extension contains EvidenceType named evidenceType 0..*  
// ...
```

VS Code Extension: Go to Definition

Right-click a FSH name and “Go to Definition” to see its definition



SD_Genomics.fsh — fhir-mCODE-ig

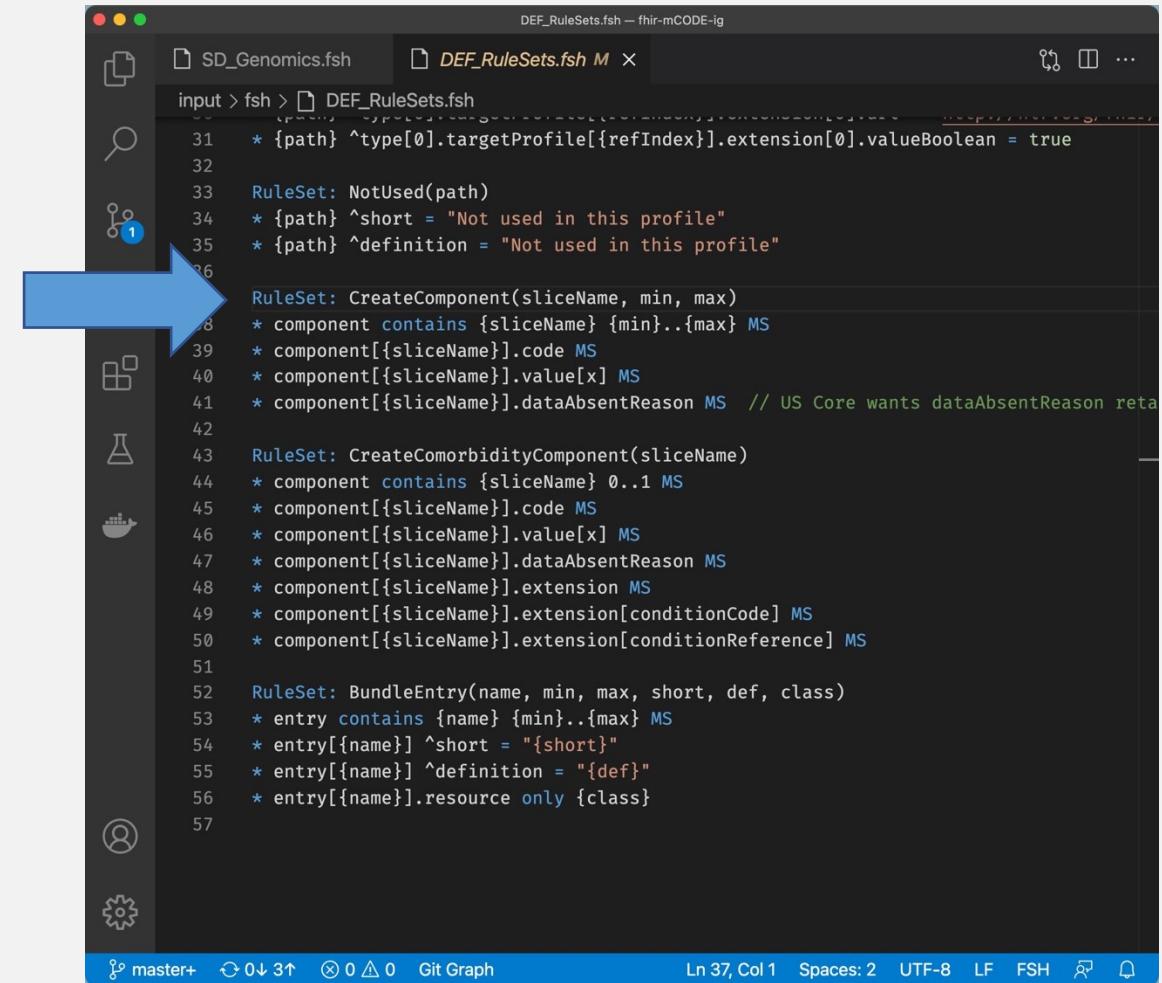
```

input > fsh > SD_Genomics.fsh
12 * value[x] only CodeableConcept
13 * value[x] ^short = "Whether the variant is present"
14 * value[x] ^definition = "The overall result of the genetic test; specifically, whe
15 * value[x] from http://loinc.org/vs/LL1971-2 (required)
16
17 * insert ObservationComponentSlicingRules
18 * insert CreateComponent(geneStudied, 0, *)
19 * insert CreateComponent(variationCode, 0, *)
20 * insert CreateComponent
  ↳ Open FHIR Documentation
21 * insert CreateComponent
  ↳ Go to Definition F12
22 * insert CreateComponent
  ↳ Peek > *)
23 * insert CreateComponent
  ↳ Debug Jest ▾ 2
24 * insert CreateComponent
  ↳ Run Jest ▾ 1
25 * insert CreateComponent
  ↳ Copy Name
26 * insert CreateComponent
  ↳ Rename
27
28 * component[geneStudied]
29 * component[geneStudied] Move
30 * component[geneStudied] Duplicate
31 * component[geneStudied] Delete
32 * component[geneStudied] [ID]
33 * component[geneStudied] targeted for mutation analysis, ident
34 * component[variationCod Concept
35 * component[variationCode].value[x] only CodeableConcept
36 * component[variationCode].value[x] from ClinVarVS (preferred)
37 * component[variationCode] ^short = "Discrete genetic variant"
38 * component[variationCode] ^definition = "The variation ID assigned by ClinVar, for
39
40 * component[genomicDNAChange].code = LNC#81290-9
41 * component[genomicDNAChange].value[x] only CodeableConcept
42 * component[genomicDNAChange].value[x] from HGVSVS (required)
43 * component[genomicDNAChange] ^short = "Genomic DNA change (gHGVS)"

```

input > fsh > SD_Genomics.fsh

Line 20, Col 25 Spaces: 4 UTF-8 LF FSH Git Graph



SD_Genomics.fsh — fhir-mCODE-ig

DEF_RuleSets.fsh — fhir-mCODE-ig

```

input > fsh > DEF_RuleSets.fsh
31 * {path} ^type[0].targetProfile[{refIndex}].extension[0].valueBoolean = true
32
33 RuleSet: NotUsed(path)
34 * {path} ^short = "Not used in this profile"
35 * {path} ^definition = "Not used in this profile"
36
37 RuleSet: CreateComponent(sliceName, min, max)
38 * component contains {sliceName} {min}..{max} MS
39 * component[{sliceName}].code MS
40 * component[{sliceName}].value[x] MS
41 * component[{sliceName}].dataAbsentReason MS // US Core wants dataAbsentReason rata
42
43 RuleSet: CreateComorbidityComponent(sliceName)
44 * component contains {sliceName} 0..1 MS
45 * component[{sliceName}].code MS
46 * component[{sliceName}].value[x] MS
47 * component[{sliceName}].dataAbsentReason MS
48 * component[{sliceName}].extension MS
49 * component[{sliceName}].extension[conditionCode] MS
50 * component[{sliceName}].extension[conditionReference] MS
51
52 RuleSet: BundleEntry(name, min, max, short, def, class)
53 * entry contains {name} {min}..{max} MS
54 * entry[{name}] ^short = "{short}"
55 * entry[{name}] ^definition = "{def}"
56 * entry[{name}].resource only {class}
57

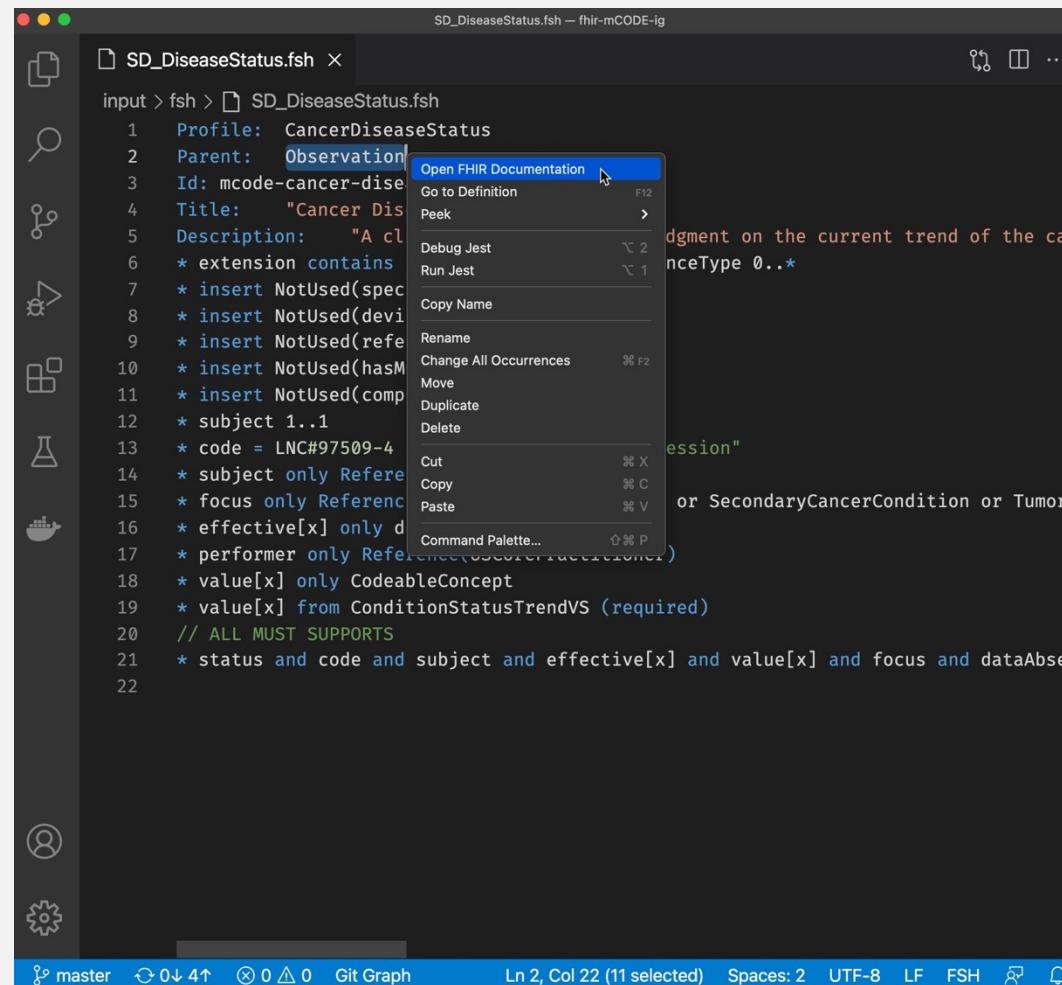
```

input > fsh > DEF_RuleSets.fsh M

Line 37, Col 1 Spaces: 2 UTF-8 LF FSH Git Graph

VS Code Extension: Go to FHIR Documentation

Right-click a FHIR name and “Go to FHIR Documentation” to see its definition

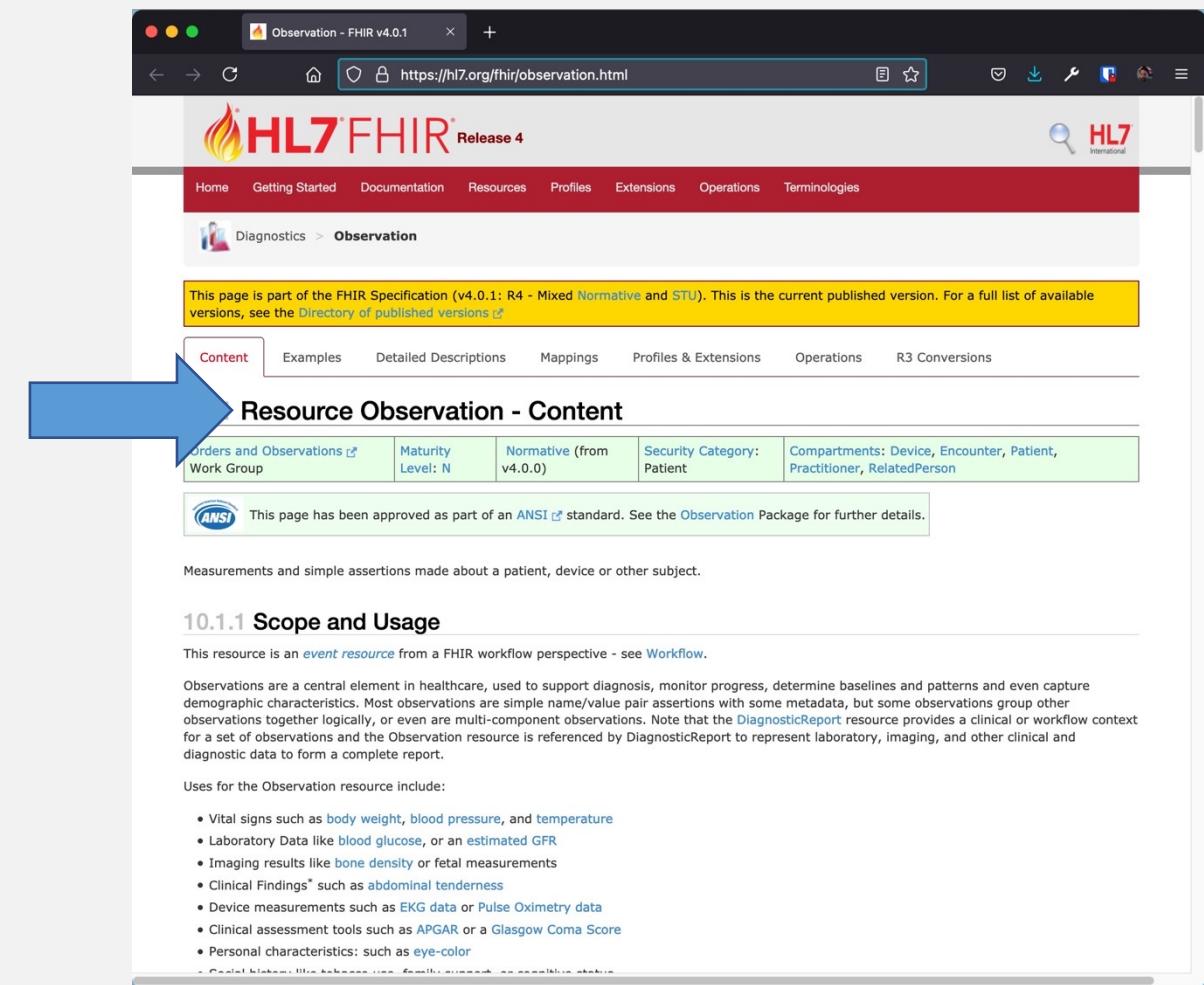


The screenshot shows a dark-themed VS Code interface with a file named SD_DiseaseStatus.fsh open. A context menu is displayed over the word "Observation" in line 2 of the code. The menu items include "Open FHIR Documentation", "Go to Definition", "Peek", "Debug Jest", "Run Jest", "Copy Name", "Rename", "Change All Occurrences", "Move", "Duplicate", "Delete", "Cut", "Copy", "Paste", and "Command Palette...". The "Open FHIR Documentation" option is highlighted.

```

SD_DiseaseStatus.fsh — fhir-mCODE-ig
input > fsh > SD_DiseaseStatus.fsh
1   Profile: CancerDiseaseStatus
2   Parent: Observation
3   Id: mcode-cancer-dise
4   Title: "Cancer Dis
5   Description: "A cl
6   * extension contains
7   * insert NotUsed(spec
8   * insert NotUsed(devi
9   * insert NotUsed(refe
10  * insert NotUsed(hasM
11  * insert NotUsed(comp
12  * subject 1..1
13  * code = LNC#97509-4
14  * subject only Refere
15  * focus only Referenc
16  * effective[x] only d
17  * performer only Reference<reference>
18  * value[x] only CodeableConcept
19  * value[x] from ConditionStatusTrendVS (required)
// ALL MUST SUPPORTS
21  * status and code and subject and effective[x] and value[x] and focus and dataAbsent
22

```



The screenshot shows a web browser window with the URL https://hl7.org/fhir/observation.html. The page is titled "Resource Observation - Content". It includes a header with the HL7 FHIR logo and navigation links for Home, Getting Started, Documentation, Resources, Profiles, Extensions, Operations, and Terminologies. A blue arrow points from the VS Code screenshot to this documentation page. The page content describes the Observation resource, its status as an ANSI standard, and its scope and usage.

This page is part of the FHIR Specification (v4.0.1: R4 - Mixed Normative and STU). This is the current published version. For a full list of available versions, see the [Directory of published versions](#).

Content

Orders and Observations Work Group Maturity Level: N Normative (from v4.0.0) Security Category: Patient Compartments: Device, Encounter, Patient, Practitioner, RelatedPerson

This page has been approved as part of an [ANSI](#) standard. See the [Observation Package](#) for further details.

Measurements and simple assertions made about a patient, device or other subject.

10.1.1 Scope and Usage

This resource is an [event resource](#) from a FHIR workflow perspective - see [Workflow](#).

Observations are a central element in healthcare, used to support diagnosis, monitor progress, determine baselines and patterns and even capture demographic characteristics. Most observations are simple name/value pair assertions with some metadata, but some observations group other observations together logically, or even are multi-component observations. Note that the [DiagnosticReport](#) resource provides a clinical or workflow context for a set of observations and the Observation resource is referenced by DiagnosticReport to represent laboratory, imaging, and other clinical and diagnostic data to form a complete report.

Uses for the Observation resource include:

- Vital signs such as [body weight](#), [blood pressure](#), and [temperature](#)
- Laboratory Data like [blood glucose](#), or an [estimated GFR](#)
- Imaging results like [bone density](#) or [fetal measurements](#)
- Clinical Findings* such as [abdominal tenderness](#)
- Device measurements such as [EKG data](#) or [Pulse Oximetry data](#)
- Clinical assessment tools such as [APGAR](#) or a [Glasgow Coma Score](#)
- Personal characteristics: such as [eye-color](#)

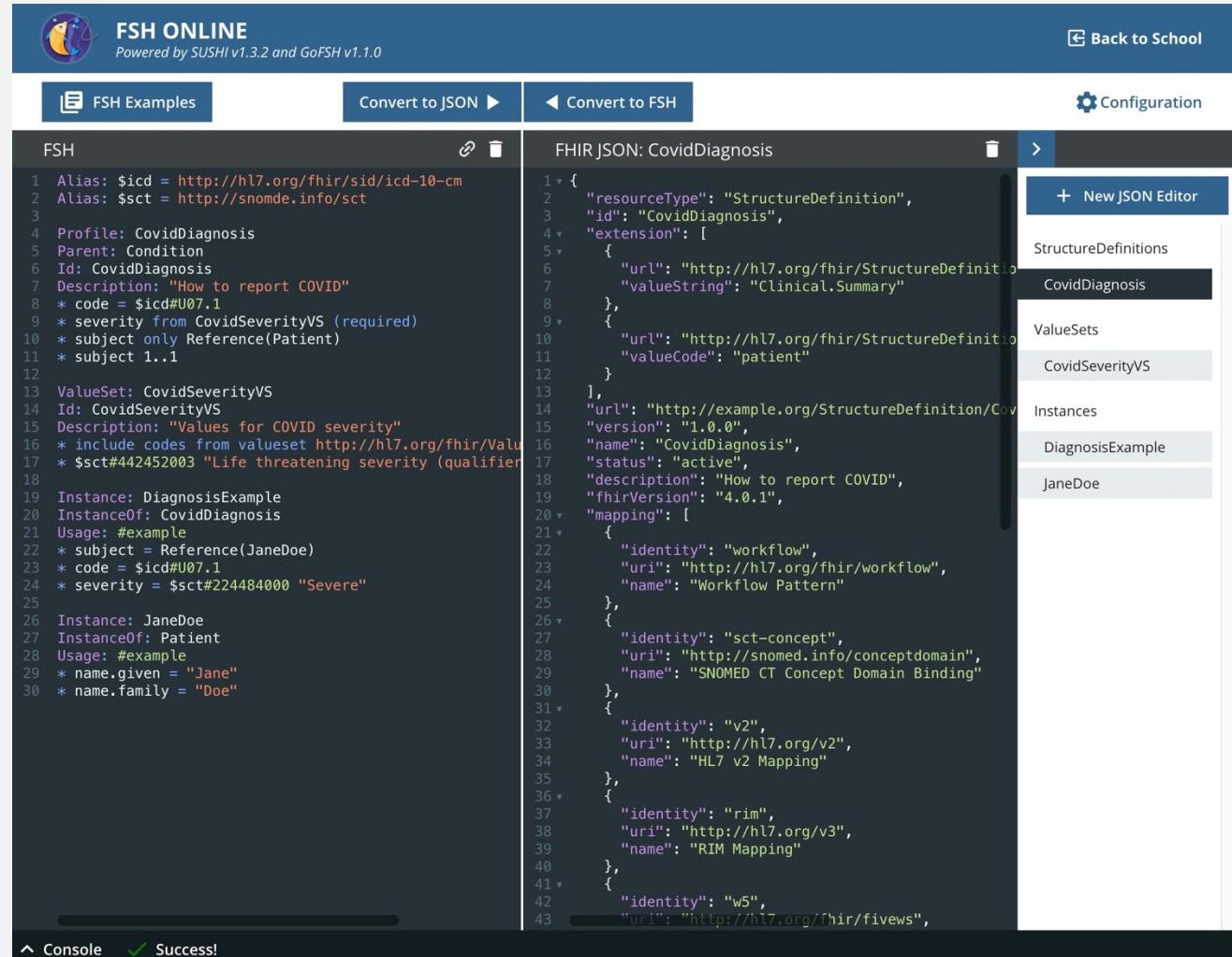
FSH Online

FSH Online Features

- Convert FSH to FHIR on the web
- Convert FHIR to FSH on the web
- Browse and Copy FSH examples
- Share FSH definitions w/ others

Recommended for:

- Quickly trying some FSH out
- Quickly converting FHIR to FSH
- Debugging FSH definitions
- Reporting errors (share your link)



The screenshot shows the FSH Online web application. At the top, there's a header with the FSH ONLINE logo, a "Back to School" button, and a "Configuration" button. Below the header, there are three tabs: "FSH Examples" (selected), "Convert to JSON ►", and "◀ Convert to FSH". On the left, there's a code editor containing FSH code. On the right, there's another code editor showing the converted FHIR JSON. The sidebar on the right lists various resources: StructureDefinitions (CovidDiagnosis), ValueSets (CovidSeverityVS), Instances (JaneDoe), DiagnosisExample, and JaneDoe.

```

FSH
1 Alias: $icd = http://hl7.org/fhir/sid/icd-10-cm
2 Alias: $sct = http://snomed.info/sct
3
4 Profile: CovidDiagnosis
5 Parent: Condition
6 Id: CovidDiagnosis
7 Description: "How to report COVID"
8 * code = $icd#U07.1
9 * severity from CovidSeverityVS (required)
10 * subject only Reference(Patient)
11 * subject 1..1
12
13 ValueSet: CovidSeverityVS
14 Id: CovidSeverityVS
15 Description: "Values for COVID severity"
16 * include codes from valueset http://hl7.org/fhir/ValueSet/covid-severity vs
17 * $sct#442452003 "Life threatening severity (qualifier"
18
19 Instance: DiagnosisExample
20 InstanceOf: CovidDiagnosis
21 Usage: #example
22 * subject = Reference(JaneDoe)
23 * code = $icd#U07.1
24 * severity = $sct#224484000 "Severe"
25
26 Instance: JaneDoe
27 InstanceOf: Patient
28 Usage: #example
29 * name.given = "Jane"
30 * name.family = "Doe"

```

```

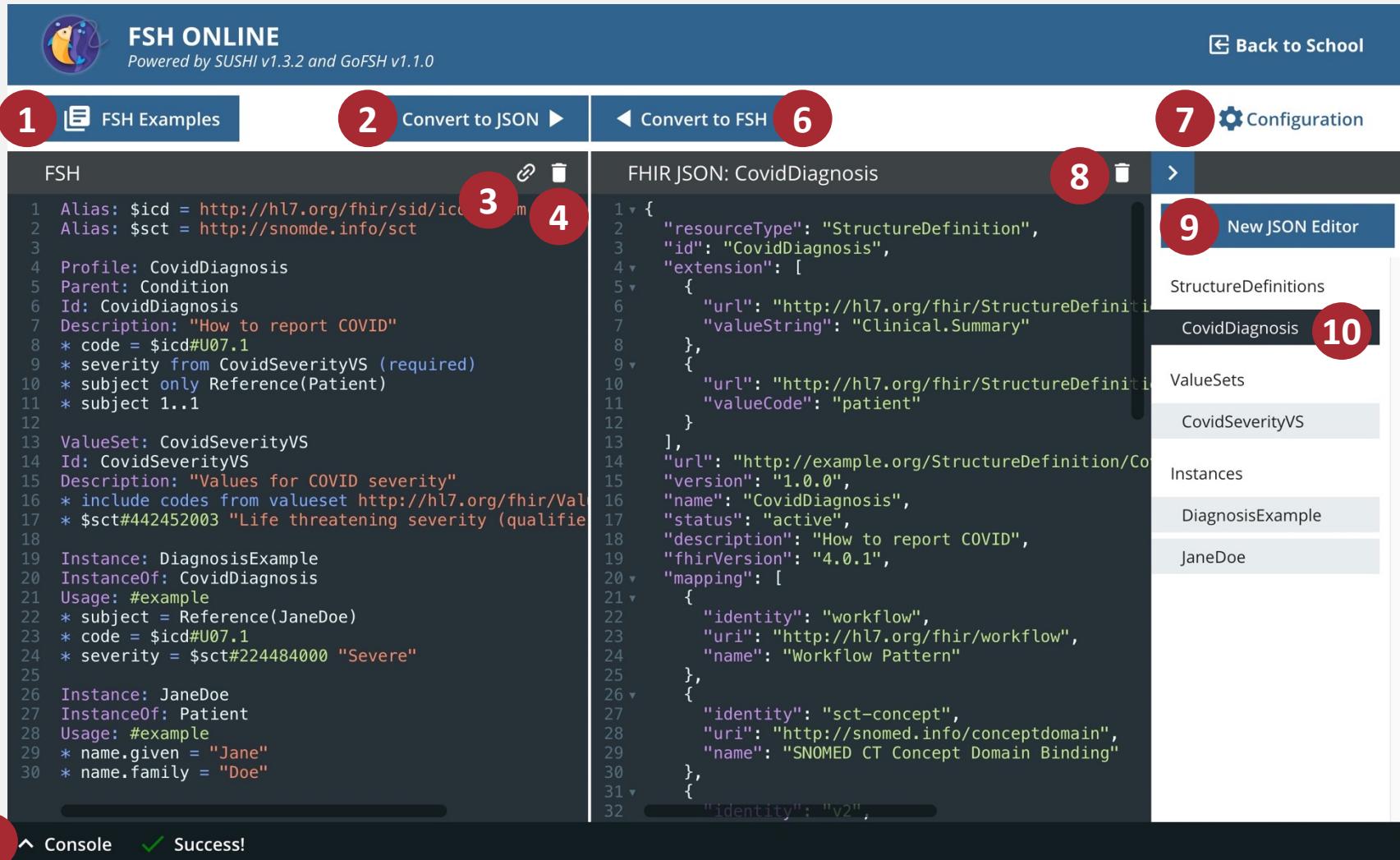
FHIR JSON: CovidDiagnosis
1 * {
2   "resourceType": "StructureDefinition",
3   "id": "CovidDiagnosis",
4   "extension": [
5     {
6       "url": "http://hl7.org/fhir/StructureDefinition/extension"
7       "valueString": "Clinical.Summary"
8     },
9     {
10       "url": "http://hl7.org/fhir/StructureDefinition/extension"
11       "valueCode": "patient"
12     }
13   ],
14   "url": "http://example.org/StructureDefinition/CovidDiagnosis"
15   "version": "1.0.0",
16   "name": "CovidDiagnosis",
17   "status": "active",
18   "description": "How to report COVID",
19   "fhirVersion": "4.0.1",
20   "mapping": [
21     {
22       "identity": "workflow",
23       "uri": "http://hl7.org/fhir/workflow",
24       "name": "Workflow Pattern"
25     },
26     {
27       "identity": "sct-concept",
28       "uri": "http://snomed.info/conceptdomain",
29       "name": "SNOMED CT Concept Domain Binding"
30     },
31     {
32       "identity": "v2",
33       "uri": "http://hl7.org/v2",
34       "name": "HL7 v2 Mapping"
35     },
36     {
37       "identity": "rim",
38       "uri": "http://hl7.org/v3",
39       "name": "RIM Mapping"
40     },
41     {
42       "identity": "w5",
43       "uri": "http://hl7.org/fhir/fivews",
44     }
45   ]
46 }

```

<https://fshschool.org/FSHOnline>

FSH Online: Features

1. Browse Examples



The screenshot shows the FSH Online interface with the following numbered features:

- FSH Examples** (Tab 1)
- Convert to JSON** (Tab 2)
- Convert to FSH** (Tab 6)
- Configuration** (Tab 7)
- Console Success!** (Status bar 5)

FSH Examples Tab (Left):

```

1 Alias: $icd = http://hl7.org/fhir/sid/icd
2 Alias: $sct = http://snomed.info/sct
3 Profile: CovidDiagnosis
4 Parent: Condition
5 Id: CovidDiagnosis
6 Description: "How to report COVID"
7 * code = $icd#U07.1
8 * severity from CovidSeverityVS (required)
9 * subject only Reference(Patient)
10 * subject 1..1
11
12 ValueSet: CovidSeverityVS
13 Id: CovidSeverityVS
14 Description: "Values for COVID severity"
15 * include codes from valueset http://hl7.org/fhir/ValueSet/CovidSeverityVS
16 * $sct#442452003 "Life threatening severity (qualifier concept)"
17
18 Instance: DiagnosisExample
19 InstanceOf: CovidDiagnosis
20 Usage: #example
21 * subject = Reference(JaneDoe)
22 * code = $icd#U07.1
23 * severity = $sct#224484000 "Severe"
24
25 Instance: JaneDoe
26 InstanceOf: Patient
27 Usage: #example
28 * name.given = "Jane"
29 * name.family = "Doe"
30
  
```

FHIR JSON Tab (Right):

```

1 {
2   "resourceType": "StructureDefinition",
3   "id": "CovidDiagnosis",
4   "extension": [
5     {
6       "url": "http://hl7.org/fhir/StructureDefinition/extension",
7       "valueString": "Clinical.Summary"
8     },
9     {
10       "url": "http://hl7.org/fhir/StructureDefinition/ValueSet",
11       "valueCode": "patient"
12     }
13   ],
14   "url": "http://example.org/StructureDefinition/CovidDiagnosis",
15   "version": "1.0.0",
16   "name": "CovidDiagnosis",
17   "status": "active",
18   "description": "How to report COVID",
19   "fhirVersion": "4.0.1",
20   "mapping": [
21     {
22       "identity": "workflow",
23       "uri": "http://hl7.org/fhir/workflow",
24       "name": "Workflow Pattern"
25     },
26     {
27       "identity": "sct-concept",
28       "uri": "http://snomed.info/conceptdomain",
29       "name": "SNOMED CT Concept Domain Binding"
30     },
31     {
32       "identity": "v2"
  
```

Configuration Tab (Bottom Right):

- New JSON Editor (9)
- StructureDefinitions (10) - CovidDiagnosis
- ValueSets (10) - CovidSeverityVS
- Instances
- DiagnosisExample
- JaneDoe

2. FSH to FHIR (SUSHI)

3. Share FSH

4. Clear FSH

5. View Log

6. FHIR to FSH (GoFSH)

7. Configure Settings

8. Clear JSON

9. New JSON

10. View JSON

FSH Online: Browse and Copy Examples (New!)

 **FSH ONLINE**
Powered by SUSHI v1.3.2 and GoFISH v1.1.0 [Back to School](#)

FSH Examples

- ✓ Aliases
 - External Aliases
 - FHIR Aliases
 - US Core Aliases
- ✗ Code Systems
 - Local Code Systems
- ✗ Extensions
 - Complex Extensions
 - Simple Extensions
- > Instances
- > Invariants
- > Mappings
- > Paths
- > Profiles
- > Rule Sets
- > Rules
- > Value Sets

Simple Extensions

```

1 // @Name: Simple Extensions
2 // @Description: Examples of extensions with values (no sub-extensions)
3
4 Extension: Laterality
5 Description: "Body side of a body location."
6 * value[x] only CodeableConcept
7 * value[x] from http://hl7.org/fhir/ValueSet/bodysite-laterality (required)
8
9 Extension: TherapySessionsCompleted
10 Id: therapy-sessions-completed
11 Title: "Therapy Sessions Completed"
12 Description: "The number of sessions of some therapy."
13 // Limit the context to Procedures -- Also see Rule Sets for a context-setting rule set
14 * ^context[+].type = #element
15 * ^context[=].expression = "Procedure"
16 * value[x] only unsignedInt // 0 or more
17
18 Extension: RelatedCondition
19 Id: related-condition
20 Title: "Condition related to the current resource"
21 Description: "The resource has an unspecified relationship with a Condition."
22 * value[x] only Reference(Condition)

```

[Copy to clipboard](#) [Close](#)

31 {
32 "identity": "v2",

▲ Console ✓ Success!

FSH Finder

100+ Implementation Guides

- US
- New Zealand
- Switzerland
- Belgium
- Denmark
- Sweden
- WHO
- DaVinci
- Covid SANER, Logica
- CARIN Blue Button
- SMART Vaccine Credential

<https://fshschool.org/fsh-finder>

FSH Finder 

Other formats ▾  Source code [Report a problem](#)

This is a list of GitHub repositories that contain **FSH** code. Please see [the README](#) for more details on how this works. Last refreshed about about 20 hours ago.

Note: you can mouse over the "FSH? 1.0" icons to see which branches in the repository support SUSHI >= 1.0. The badge is dimmed () if FSH is not supported on [main](#) or [master](#).

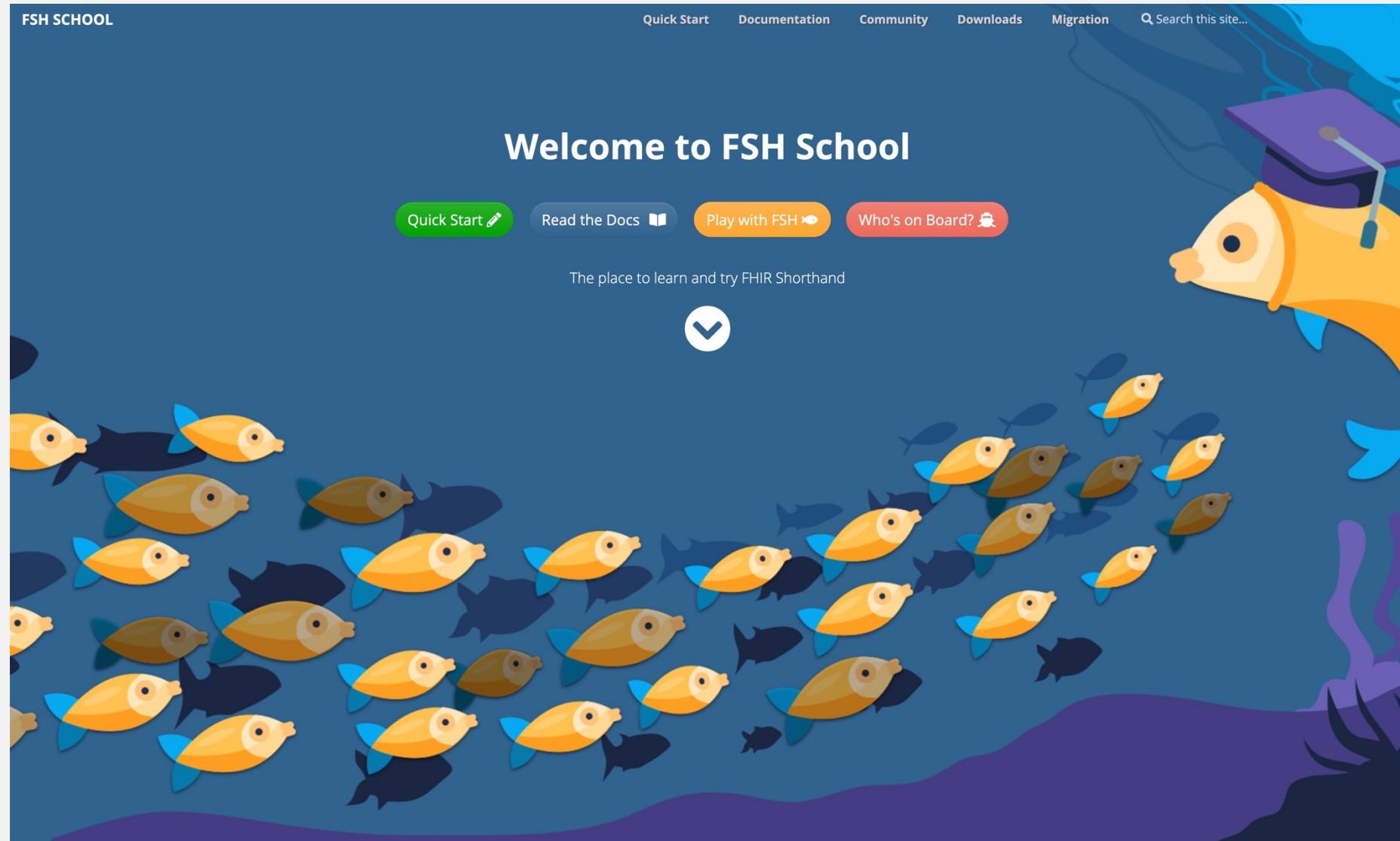
#	Implementation Guide	FSH Version	FSH: Profile	FSH: Instance	FSH: Extension	FSH: ValueSet	FSH: CodeSystem
1	item-715-data  oridashi / item-715-data updated about 21 hours ago [CI build]	 1.0	 Yes	 Yes	 Yes	 No	 No
2	CH eTOC (R4)  hl7ch / ch-etoc updated a day ago [CI build]	 1.0	 Yes	 Yes	 Yes	 Yes	 Yes
3	Mobile access to Health Documents (MHD)  IHE / ITI.MHD updated 2 days ago [CI build]	 1.0	 Yes	 Yes	 Yes	 Yes	 Yes
4	PACIO Advance Directive Interoperability Implementation Guide  HL7 / pacio-adi updated 2 days ago [CI build]	 1.0	 Yes	 Yes	 Yes	 Yes	 Yes
5	riziv-inami  hl7-be / riziv-inami updated 2 days ago [CI build]	 1.0	 Yes	 Yes	 Yes	 Yes	 Yes
6	Da Vinci Prior Authorization Support (PAS) FHIR IG  HL7 / davinci-pas updated 2 days ago [CI build]	 1.0	 Yes	 Yes	 Yes	 Yes	 Yes
7	Patient Demographics Query for Mobile  IHE / ITI.PDQm updated 2 days ago [CI build]	 1.0	 Yes	 Yes	 Yes	 No	 No
8	SPL Mapping FHIR Implementation Guide  HL7 / fhir-spl updated 2 days ago [CI build]	 1.0	 Yes	 Yes	 Yes	 Yes	 Yes
9	CH RAD-Order (R4)  hl7ch / ch-rad-order updated 3 days ago [CI build]	 1.0	 Yes	 Yes	 Yes	 Yes	 Yes
10	HL7 FHIR Implementation Guide: Standard Health Record (SHR) Adverse Events Release 1 - DRAFT  standardhealth / fsh-ae updated 3 days ago [CI build]	 1.0	 Yes	 Yes	 Yes	 Yes	 Yes

FSH School

Your portal to

- FSH Online
- FSH Finder
- SUSHI docs
- GoFSH docs
- Tutorials
- Presentations
- Other resources

<https://fshschool.org>



FSH Resources and Tools

- [FSH Language Specification](#) -- HL7 FHIR Standard
- [SUSHI](#) -- compile FSH into FHIR Artifacts
- [FSH School](#) -- web site with documentation, tools, examples
- [FSH Online](#) -- interactive FHIR Shorthand with examples
- [GoFSH](#) -- convert existing implementation guides into FSH (beta)
- [FSH Finder](#) -- web crawler to find FSH projects
- [VS Code extension](#) -- code highlighter for VS Code editor
- [# shorthand](#) -- Zulip chat channel

Track overview: Let's Build a FHIR specification

Introduction to FHIR
11:00 – 11:45

Introduction Profiling
1:00 – 1:45

Accelerating your IG production
1:00 – 1:45

FHIR Registry & Packages
1:00 – 1:45



Profiling with Forge
2:15 – 3:00



IG with IG Publisher
2:15 – 3:00



Publishing with Simplifier.net
2:15 – 3:00

Create an IG with
FHIR Shorthand
3:15 – 4:00



Create an IG with
FHIR Shorthand
4:15 – 5:00



Advanced FHIR Shorthand
and Tools
3:15 – 4:00



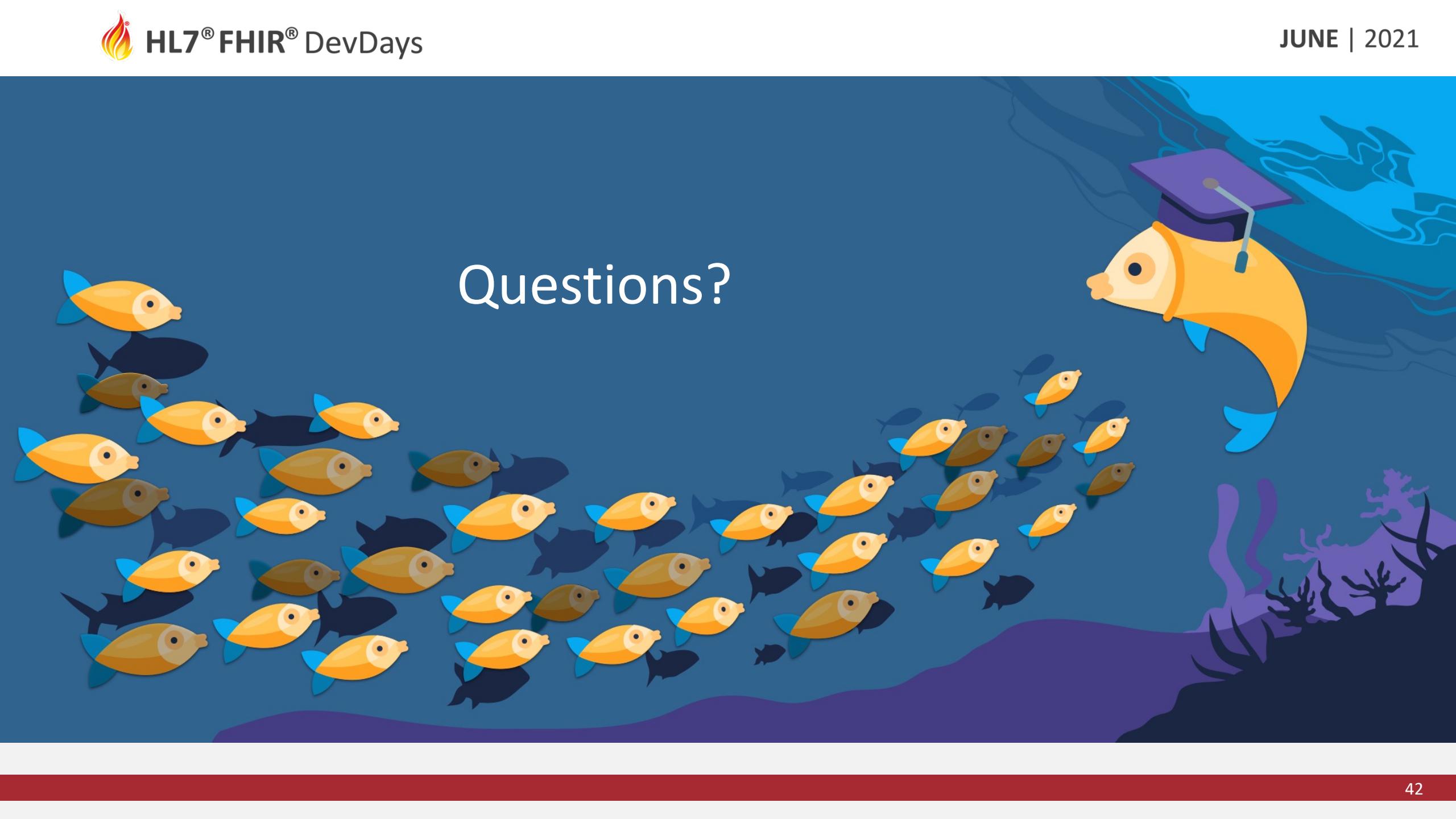
You were here

Monday

Tuesday

Wednesday

Thursday



Questions?

ORGANIZED BY



PARTNER

