

Automated Verification of Structured Questionnaires Using HL7[®] FHIR[®]

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April 8, 2019



Research Study



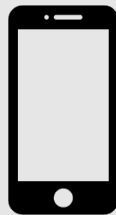
Participate in research study.

Consent Process



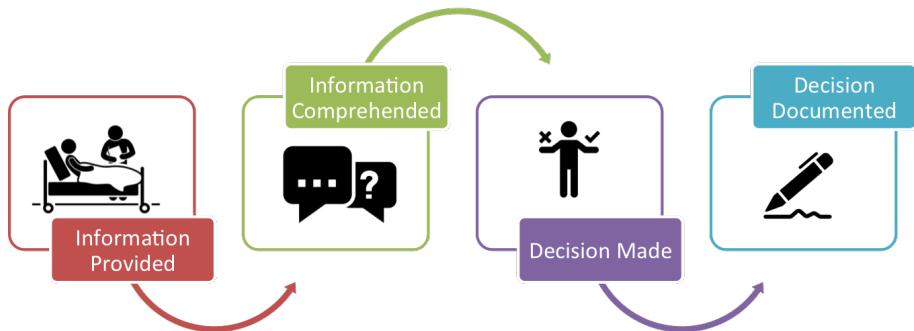
Sign consent agreement.

Remote Sign Up

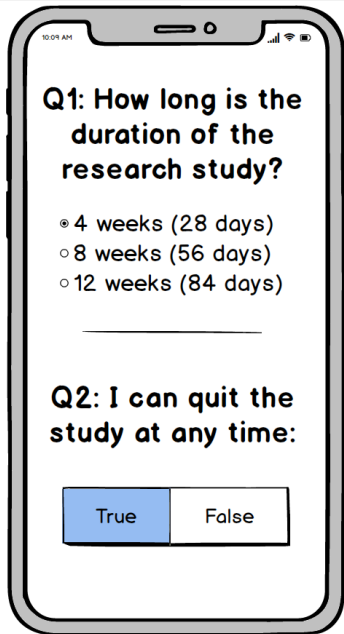


Sign up and give consent remotely.

- Risks
- Benefits
- Alternatives



Quiz Example



Quiz Example with FHIR

A smartphone mockup displaying a quiz interface. The screen shows two questions. The first question is a multiple-choice question about the duration of a research study, with three options: 4 weeks (28 days), 8 weeks (56 days), and 12 weeks (84 days). The second question is a true/false question: "I can quit the study at any time:", with a blue button labeled "True" and a white button labeled "False".

10:09 AM

Q1: How long is the duration of the research study?

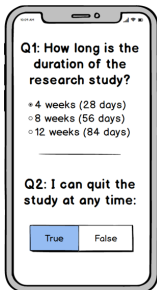
- 4 weeks (28 days)
- 8 weeks (56 days)
- 12 weeks (84 days)

Q2: I can quit the study at any time:

```
{
  "resourceType": "Questionnaire",
  "name": "Research Study Quiz",
  "item": [
    {
      "linkId": "qu.duration",
      "text": "Q1: How long is the duration of the
        research study?",
      "type": "choice",
      "answerOption": [
        { "valueString": "4 weeks (28 days)" },
        { "valueString": "8 weeks (56 days)" },
        { "valueString": "12 weeks (84 days)" }
      ]
    },
    {
      "linkId": "qu.quit",
      "text": "Q2: I can quit the study at any time:",
      "type": "boolean"
    }
  ]
}
```

Four approaches:

- Extensions
- POST Interceptor
- FHIR Operation
- CDS Hooks



Comparison of Approaches



Approach	Verification By	Standard Compliance	Security
Extension	Client	✓	-
POST Interceptor	Server	-	✓
FHIR Operation	Server	✓	✓
CDS Hooks	Server	○	-

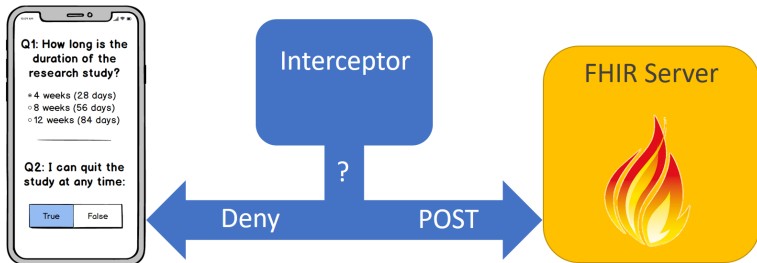
- Correct answers in Questionnaire
- Verification on the client before the POST

```
{
  ...
  "item": [
    {
      "linkId": "qu01",
      "text": "Q1: How long is the duration of the research study?",
      "type": "choice",
      "extension": [
        {
          "url": „http://example.com/StructureDefinition/correct-answer“,
          "valueString": "4 weeks (28 days)"
        }
      ]
      "answerOption": [
        {"valueString": "4 weeks (28 days)"},
        {"valueString": "8 weeks (56 days)"},
        {"valueString": "12 weeks (84 days)"}
      ]
    }
  ]
}
```

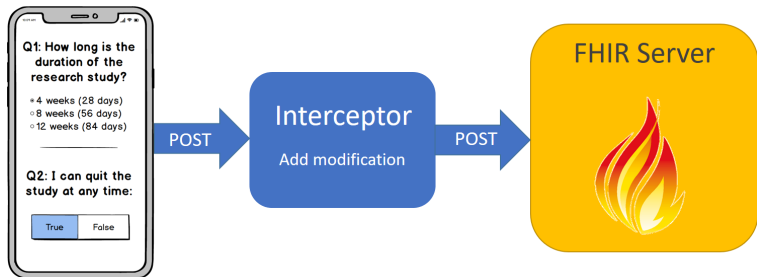

POST Interceptor Approach



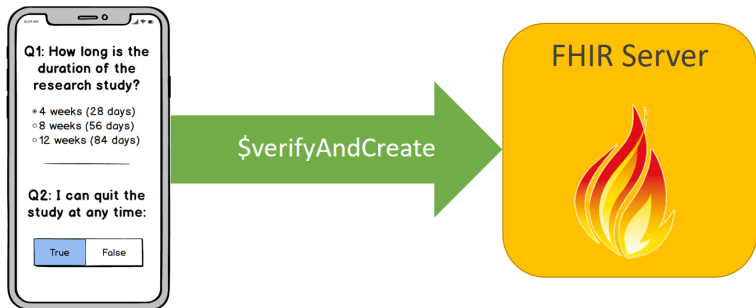
- Correct answers on server
- Verification triggered by the POST
- Wrong answers are either:
 - Denied
 - Forwarded in a modified way (e.g., by adding the status "verification failed")



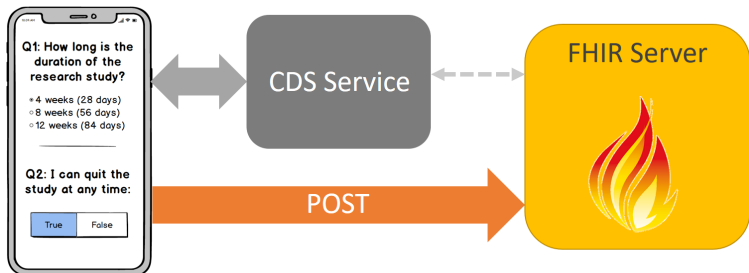
- Correct answers on server
- Verification triggered by the POST
- Wrong answers are either:
 - Denied
 - Forwarded in a modified way (e.g., by adding the status "verification failed")



- Correct answers on server
- Verification and creation triggered by operation call `$verifyAndCreate`



- Correct answers verified by Clinical Query Language (CQL)
- Verification by call to CDS system
- Creation by separate POST



Comparison of Approaches



Approach	Verification By	Standard Compliance	Security
Extension	Client	✓	-
POST Interceptor	Server	-	✓
FHIR Operation	Server	✓	✓
CDS Hooks	Server	○	-