HL7 FHIR Towards Achieving the Interoperability of Social Determinants of health

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TWO Main Concepts

**Health Data Interoperability**
The Ability of two health systems to exchange data.

**Social Determinants of Health**
New Emerging types of Data
Social Determinants Of Health Data

Non-Medical Factors Which Affect Human Health

- Economic Stability
- Healthcare Services
- Education
- Physical
- Social and
Health data Standards

SNOMED-CT       HL7-FHIR

ICD             LOINC

IHE             DICOM

ADA             OpenMRS
What is FHIR

**Fast Health Interoperability Resources**

- The Latest HL7 Standard for exchanging electronic healthcare information
- A set of modular components called “Resources”
- Exchange resources between systems using RESTFul API.
ALL it's about “Resources”

Building Blocks

- Related Person
- Patient
- Diagnostic Report
- Practitioner
- Location
A resource’s REST Identify

http://exampleServer.org/fhir/Patient/120

Resource Type

Server Endpoint

Identifier
Paradigms

- FHIR supports Four Paradigms

- **Simple,**
  - HTTP Methods
  - Pre-defined Operations

- **Collection of resources bound together**
  - Packaged, sent and received as a bundle.

- **Multiple resources in a single exchange**

- **Based on SOA principles**
  - Ultra simple
  - Individual resources or collections
Disparate Systems can communicate
FHIR: Services

Data Described

Or

Shared Electronically

Share Information in a consistent manner

Or

Describes Data

JSON

XML
SDH and Health IT

- Incorporate SDH data into diagnosis, predictions, decisions making
- Integrate them into healthcare services
- Enable their interoperability
Problem Statement

• Data not available

• Data are from different sources

• Complexity, Multiplicity, diversity
Project Goals

Health Surveys

Storage

FHIR
TWO FHIR Resources

Questionnaire

QuestionnaireResponse
Map SDH Data into FHIR Resources

**Data**

- **Social Determinants**
  - Determinant Id
  - Date of Survey
  - Type of Survey
  - Determinant 1
  - Determinant 2
  - ...

- **Answers**
  - Answer Id
  - Questions
  - Respondent
  - Date of Interview
  - Response 1
  - Response 2

- **Respondent**
  - Id
  - First Name, Family Name
  - Location
  - Date of Birth

**FHIR Resources**

- **Questionnaire**
  - Identifier
  - Date
  - Purpose
  - Item 1
  - Item 2
  - ...

- **QuestionnaireResponse**
  - Questionnaire (Reference)
  - Patient (Reference)
  - Authored
  - Item 1
  - Item 2
  - Item 3

- **Patient**
  - Identifier
  - Name(family, Given)
  - Address
  - BirthDate
Implementation: Data Model

Simplified Data Model

Patient
- Id: Identifier
- Name: HumanName
- Birthdate: Date
- address: Address

Questionnaire
- IdDeterminant: Identifier
- DateOfSurvey: DateTime
- Purpose: Markdown
- SourceOfDrinkingWater: String
- HasElectricity: boolean
- MainRoofMaterial: String

QuestionnaireResponse
- IdResponse: Identifier
- questionnaire: Questionnaire
- Subject: Patient
- Authored: DateTime
- Response1: String
- Response2: String
- Response: String
System Architecture

HTTP

VONK SERVER FHIR
Mapper
Search
Create
Update
Delete

SQL SERVER
Operations

Get Method: http://localhost:5020/Patient/2
HTTP / 1.1 200 OK
Content-Type: application/json+fhir

```json
{
    "resourceType": "Patient",
    "id": "2",
    "name": [
        {
            "family": "Nakamura",
            "given": [
                "Akiko"
            ]
        }
    ],
    "birthDate": "1986-06-01T00:00:00+09:00",
    "address": [
        {
            "city": "Sendai Miyagi"
        }
    ]
}
```
Get Method: http://localhost:5020/Questionnaire/1
HTTP / 1.1 200 OK
Content-Type: application/json+fhir

```json
{
    "resourceType": "Questionnaire",
    "id": "1",
    "description": "DHS Survey Series Senegal",
    "purpose": "Mapping SDH data into FHIR resources",
    "item": [
        {
            "linkId": "Source Of Drinking Water",
            "text": "What is The source of your drinking water?",
            "type": "string",
            "required": true,
            "repeats": false
        },
        {
            "linkId": "Has electricity",
            "text": "Do you have electricity?",
            "type": "string",
            "required": true,
            "repeats": false
        },
        {
            "linkId": "Main Floor material",
            "text": "The main floor Material",
            "type": "string",
            "required": true,
            "repeats": false
        }
    ]
}
```
HTTP / 1.1 200 OK
Content-Type: application/json+fhir

```json
{
    "resourceType": "Bundle",
    "id": "03f7c883-ae6c-4ab5-b3cd-3e86af90f2c",
    "meta": {
        "versionId": "d9a14311-736d-47af-8ced-50988f164313",
        "lastUpdated": "2019-02-13T12:17:19.614+09:00"
    },
    "type": "searchset",
    "total": 1,
    "link": [
        {
            "relation": "self",
            "url": "http://localhost:5020/QuestionnaireResponse"
        }
    ],
    "entry": [
        {
            "fullUrl": "http://localhost:5020/QuestionnaireResponse/1",
            "resource": {
                "resourceType": "QuestionnaireResponse",
                "id": "1",
                "questionnaire": {
                    "reference": "http://localhost:5020/Determinants/1"
                },
                "status": "completed",
                "subject": {
                    "reference": "http://localhost:5020/Householder/2"
                }
            }
        }
    ],
    "authored": "2015-08-01T00:00:00+09:00",
    "author": {
        "reference": "http://localhost:5020/Sow"
    },
    "item": [
        {
            "linkId": "Survey Purpose",
            "answer": [
                {
                    "valueString": "DHS Survey Series"
                }
            ]
        },
        {
            "linkId": "Source of drinking Water",
            "answer": [
                {
                    "valueString": "Public Tap"
                }
            ]
        },
        {
            "linkId": "Household with electricity",
            "answer": [
                {
                    "valueString": "True"
                }
            ]
        }
    ]
}
```
Other Operations

The system handles appropriately other CRUD operations including:

• Create, Update and Delete a resource
• Sending *questionnaire* and *QuestionnaireResponse* to external FHIR servers.
Conclusion

- FHIR is a good standard which fits SDH data.
- Many benefits including extensible, support for modern web technologies,
- Good documentation and it is Open source.

Using `questionnaire` and `questionnaireResponse` to capture SDH is consistent and ubiquitous in healthcare.
Thank You