



Defining FHIR Resources and Profiles



1. Observation:

The FHIR observation resources will enable the capturing of important **patient generated health data (PGHD)** parameters belonging to patients suffering from diabetes and/or obesity. Specifically:

[Body Weight](#), [Body Height](#), [BMI](#), and [Blood Pressure](#) are based on the US core “vital sign” profile here: <https://www.hl7.org/fhir/observation-vitalsigns.html>, but with the modifications according to the [Israeli core observation profile](#):

In the section “*Finnish PHR Blood Pressure profile*” in the **Finnish PHR implementation guide (IG) R4**:

<https://simplifier.net/guide/FinnishPHRImplementationGuideR4/FinnishPHRVitalSignsProfiles>, we can see the implementation of this profile as a US Core vital sign profile, for example Blood pressure is under the [BP StructureDefinition](#).

Fasting glucose level - This type of observation resource will be taken as is, without any extension, such as this example: <http://hl7.org/fhir/observation-example-f001-glucose.json.html>, except with the SNOMED-CT code / “magic value”: 271062006 which stands for “*Fasting blood glucose measurement*” with the UCUM units “mg/dL” or “mmol/L”:

```
"code": {
  "coding": [
    {
      "system": "http://snomed.info/sct",
      "code": "271062006",
      "display": "Fasting blood glucose measurement"
    }
  ]
},
```

Average daily liquid intake - This resource captures the average daily liquid consumption of the patient, whether it is coming from our weekly, biweekly, or monthly report.

This type of observation can also be taken as is with no extensions such as the fasting glucose level, except with the “magic value” 784184006 in SNOMED-CT which stands for “*Estimated oral fluid intake in 24 hours*”. The UCUM unit is “mL/(24.h)” which stands for “*milliliter per 24 hours*”.

We shall add no more than a single component field as mandatory (cardinality of 1..1) in order to declare the type of liquid.

For example:

```
"component": [
  {
    "code": {
      "coding": [
        {
          "system": "http://snomed.info/sct",
          "code": "406142009",
          "display": "Type of fluid"
        }
      ]
    },
    "valueCodableConcept": {
      "coding": [
        {
          "system": "http://snomed.info/sct",
          "code": "11713004",
          "display": "Water"
        }
      ]
    }
  }
]
```

Average daily steps - This resource captures the average daily steps taken by the patient, whether it is coming from our weekly, biweekly or monthly report. This type of observation can also be taken as is with no extensions such as the fasting glucose level, except with the “magic value” 41951-5 in LOINC which stands for “*Number of steps in 24 hour mean Measured*”. The UCUM unit is “/(24.h)” which stands for “*per 24 hours*”.

Average Weekly physical activity in days - This resource captures the weekly physical activity report from the patient, and it gives the result as days of activity per week. The result is a float, and not an integer. If a patient had a total of 9 hours of physical activity in one week (e.g. 3 hours of riding a bicycle, 2 hours of swimming, and 4 in the gym), then that patient has been dedicating $9/24 = 0.375$ days a week of physical activity.

This type of observation can also be taken as is with no extensions such as the fasting glucose level, except with the “magic value” 77293-9 in LOINC which stands for “*Days per week of moderate to vigorous physical activity*”, and the UCUM unit is “d/wk” which means “*day per week*”.

Fasting duration in hours - This resource captures the total reported fasting hours of the patient, in a specific period in time (day, week, two weeks, month, etc..). This type of observation can also be taken as is with no extensions such as the fasting glucose level, except with the “magic value” 87527-8 which stands for “*Fasting duration*”, and the UCUM unit is “h” which stands for “*hour*”.

All types of observations above are critical and helps the practitioners in decision making and patient evaluation (regression/deterioration, remission, etc) and thus treatment of various health conditions, especially related to chronic illnesses such as diabetes and obesity.

By aggregating more data from outside of the hospital/clinic/HMOs to healthcare providers in those organizations, this will lead to a more consistent approach in healthcare, and achieving more information about the patient that otherwise wouldn't be pulled and pushed to the patient's EHR in the hospital/HMO.

Important remark: In all observation resources above, we would like them all to conform with the [IL-Core observation profile](#). For instance, we want to modify the data type of the field “subject” from Reference(Patient), to: Reference(ILCore Patient Profile| Group| ILCore Device Profile| ILCore Location Profile), and so on.

2. **MedicationAdministration:**

This resource helps us capture all drug self-administrations, at a specific point in time, by the patient. When a patient voluntarily declares that he took a drug after receiving a reminder, a new record of MedicationAdministration is then created. Sharing this information is very important to quantify the level of adherence of a patient to the treatment protocol.

The resource will be taken as is, with only one modification: The field "[medicationReference](#)" will be of data type Reference(ILCore Medication Profile) instead of Reference(Medication), to conform with the ILCore medication profile.

3. **MedicationRequest / ServiceRequest:**

These resources will capture the practitioner requests from the patient, to take certain medications, or perform certain tests at home or at a lab. This resource holds information that is critical to the care plan. We can capture the approach of the doctor to the treatment process.

This resource will conform to the IL-Core [MedicationRequest](#) and [ServiceRequest](#) profiles.

4. **QuestionnaireResponse:**

Based on the **PRO FHIR IG SDC** QuestionnaireResponse profile, which is used for basic QuestionnaireResponse collection:

<http://hl7.org/fhir/uv/sdc/2018Sep/sdc-questionnaireresponse.html>

But with the R4 version, we'll use this resource to capture all questions and answers of the weekly SF-12 and monthly SF-36(2nd version) Quality of Life (QoL) Surveys, as known as the MOS (Medical Outcomes Study) 12-item and 36-Item Short Form Health Survey.

These surveys are meant for assessment of the patient's QoL (Quality of Life), which is also important for the process of evaluating a patient and establishing the right care plan.

A snippet from a representation for a SF-36 survey questions and answers:

```
"item": [
  {
    "linkId": "5",
    "text": "During the past 4 weeks, how much of the time have you
had any of the following problems with your work or other regular daily
activities as a result of any emotional problems (such as feeling
depressed or anxious)?",
    "item": [
      {
        "linkId": "5.a",
        "text": "Cut down the amount of time you spent on work or
other activities",
        "answer": [
          {
            "valueCoding": {
              "code": "5",
              "display": "None of the time"
            }
          }
        ]
      },
      {
        "linkId": "5.b",
        "text": "Accomplished less than you would like",
        "answer": [
          {
            "valueCoding": {
              "code": "2",
              "display": "Most of the time"
            }
          }
        ]
      }
    ]
  },
  {
    "linkId": "5.b",
    "text": "Accomplished less than you would like",
    "answer": [
      {
        "valueCoding": {
          "code": "2",
          "display": "Most of the time"
        }
      }
    ]
  },
  {
    "linkId": "5.b",
    "text": "Accomplished less than you would like",
    "answer": [
      {
        "valueCoding": {
          "code": "2",
          "display": "Most of the time"
        }
      }
    ]
  }
],
```

```

    {
      "linkId": "5.c",
      "text": "Didn't do work or other activities as carefully as
usual",
      "answer": [
        {
          "valueCoding": {
            "code": "1",
            "display": "All of the time"
          }
        }
      ]
    }
  ]
}
]

```

Important Remark: This resource shall conform with the [IL-Core QuestionnaireResponse profile](#).

5. **DiagnosticReport:**

This resource enables the capturing of whole reports of a single patient, which gives a wider picture, a profile, of the patient.

The resource shall conform with the [IL-Core DiagnosticReport profile](#), and will contain a bundle of only one of the following, that are associated with the patient including their references:

- A. Vital signs
- B. Lab tests
- C. Average steps + Physical activity + Fasting duration

6. **ValueSet:**

Besides using SNOMED-CT, RxNorm, NDC, ICD, LOINC, UCUM, and IL-Core [CodeSystems](#) and [ValueSets](#) when needed, we wish to expand the device type codes to capture our devices, such as wearable devices or apps that generate metrics (e.g. Garmin watch that can measure heart rate or respiration rate).

Changes:

- The [QuestionnaireResponse](#) was added to the project, because this resource best describes our participant records in responding to various surveys.
- We added the [MedicationAdministration](#) resource, because this is the right resource for capturing a patient record which declares taking a medication at a specific point in time.
- We added the [MedicationRequest](#) resource, because this resource is the suitable resource for holding requests for drug administrations, from the doctor to the patient, when using our dashboard.

Motivation and business insights - See FHIR use cases here:

<https://hl7.org/fhir/uv/phd/2018Jan/UseCases.html> - examples 1-3 are all relevant to our goals in this project as well.

Exchanging hospitals/HMOs and IMNA Solutions' resources will help integrate IMNA's PHR with their EHR system, leading to tremendous outcomes for both sides:

- More information gained for hospitals/HMOs regarding the patients.
- More information gained for IMNA about their patient. This will give us a broader picture and insights on the patients, and will upgrade digital health, and improve our services, leading to enhanced patient-provider engagement and healthcare protocol adherence from the patient side.
- Through FHIR protocol, it will help reduce time and cost of a seemingly complex interoperability.
- Will help enhance and improve clinical research, for healthcare organizations.