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# Access FHIR server and query data in Python

NOTE: In order to access Monash FHIR server, you need to connect to monash VPN.

To make HTTP request with *Python's Request Library*. You need to install request with command "pip install requests" and import requests in the script.

In [1]:

```
import requests
import pandas as pd
from datetime import datetime
```

Provide **root url** for the server.

In [2]:

```
root_url = 'http://hapi-fhir.erc.monash.edu:8080/baseDstu3/'
```

## Example 1

To get a **specific FHIR resource** from a FHIR server, extend the root url by appending the resource type you are looking for. e.g.[root\_url]/Patient will return a bundle including all patients.

In [3]:

```
patient_url = root_url + "/Patient"
```

To get a particular Patient resource, you would want to use a Patient's id. Simply extend the patient\_url by appending the patient's id.

In [4]:

```
Patient_6430_url = patient_url + "/6430"
```

We retrieve JSON data using HTTP request and use the builtin **JSON decoder** -json().

In [5]:

```
data = requests.get(url=Patient_6430_url).json()
```

In [6]:

```
data
```

Out[6]:

```
{'resourceType': 'Patient',
  'id': '6430',
  'meta': {'versionId': '1', 'lastUpdated': '2019-05-01T11:41:19.950+
10:00'},
  'text': {'status': 'generated',
    'div': '<div xmlns="http://www.w3.org/1999/xhtml">Generated by <a
href="https://github.com/synthetichealth/synthea">Synthea</a>.Versio
n identifier: ddcacfdb\n .   Person seed: 2666193951888038839  Popul
ation seed: 20</div>'},
  'extension': [{'url': 'http://hl7.org/fhir/us/core/StructureDefinit
ion/us-core-race',
    'extension': [{'url': 'ombCategory',
      'valueCoding': {'system': 'urn:oid:2.16.840.1.113883.6.238',
        'code': '2106-3',
        'display': 'White'}}},
      {'url': 'text', 'valueString': 'White'}}]},
    {'url': 'http://hl7.org/fhir/us/core/StructureDefinition/us-core-e
thnicity',
      'extension': [{'url': 'ombCategory',
        'valueCoding': {'system': 'urn:oid:2.16.840.1.113883.6.238',
          'code': '2186-5',
          'display': 'Not Hispanic or Latino'}}},
        {'url': 'text', 'valueString': 'Not Hispanic or Latino'}}]},
      {'url': 'http://hl7.org/fhir/StructureDefinition/patient-mothersMa
idenName',
        'valueString': 'Jenette717 Schmitt836'},
      {'url': 'http://hl7.org/fhir/us/core/StructureDefinition/us-core-b
irthsex',
        'valueCode': 'M'},
      {'url': 'http://hl7.org/fhir/StructureDefinition/birthPlace',
        'valueAddress': {'city': 'Austin', 'state': 'Texas', 'country':
'US'}}},
      {'url': 'http://synthetichealth.github.io/synthea/disability-adjus
ted-life-years',
        'valueDecimal': 2.3045200277933913},
      {'url': 'http://synthetichealth.github.io/synthea/quality-adjusted
-life-years',
        'valueDecimal': 78.69547997220661}},
    'identifier': [{'system': 'https://github.com/synthetichealth/synth
ea',
      'value': 'f1827d18-16c5-4c1e-8dc3-ff583b6a17fd'},
      {'type': {'coding': [{'system': 'http://hl7.org/fhir/v2/0203',
        'code': 'MR',
        'display': 'Medical Record Number'}]},
        'text': 'Medical Record Number',
        'system': 'http://hospital.smarthealthit.org',
        'value': 'f1827d18-16c5-4c1e-8dc3-ff583b6a17fd'},
      {'type': {'coding': [{'system': 'http://hl7.org/fhir/identifier-ty
pe',
        'code': 'SB',
        'display': 'Social Security Number'}]},
        'text': 'Social Security Number',
        'system': 'http://hl7.org/fhir/sid/us-ssn',
        'value': '999-11-1298'},
      {'type': {'coding': [{'system': 'http://hl7.org/fhir/v2/0203',
        'code': 'DL',
        'display': "Driver's License"}]},
        'text': "Driver's License",
        'system': 'urn:oid:2.16.840.1.113883.4.3.25',
```

```

    'value': 'S99986270'},
    {'type': {'coding': [{'system': 'http://hl7.org/fhir/v2/0203',
        'code': 'PPN',
        'display': 'Passport Number'}]},
        'text': 'Passport Number'},
        'system': 'http://standardhealthrecord.org/fhir/StructureDefiniti
on/passportNumber',
        'value': 'X72101490X'}],
    'name': [{'use': 'official',
        'family': 'Veum823',
        'given': ['Ali918'],
        'prefix': ['Mr.']}],
    'telecom': [{'system': 'phone', 'value': '555-695-6723', 'use': 'ho
me'}],
    'gender': 'male',
    'birthDate': '1937-12-18',
    'address': [{'extension': [{'url': 'http://hl7.org/fhir/StructureDe
finition/geolocation',
        'extension': [{'url': 'latitude', 'valueDecimal': 32.794176},
            {'url': 'longitude', 'valueDecimal': -96.765503}]}],
        'line': ['876 Vandervort Mews'],
        'city': 'Dallas',
        'state': 'Texas',
        'postalCode': '75001',
        'country': 'US'}],
    'maritalStatus': {'coding': [{'system': 'http://hl7.org/fhir/v3/Mar
italStatus',
        'code': 'M',
        'display': 'M'}]},
        'text': 'M'},
    'multipleBirthBoolean': False,
    'communication': [{'language': {'coding': [{'system': 'urn:ietf:bc
p:47',
        'code': 'en-US',
        'display': 'English'}]},
        'text': 'English'}}]}

```

## Example 2 - Search upon parameters

**Each resource type defines the parameters which you can search upon it.** To search upon parameters, we construct a URL starting with the root url followed by the resource type(e.g. Observation), a question mark character '?' and finished with the search parameters we wish to search, Patient=6430 in this case.

In [7]:

```
search1_url = root_url + "/Observation?patient=6430"
```

To search on a particular observation, we can set the code for that observation. For example, 'total cholesterol' has the code '2093-3'. So when we want to get the patient's total cholesterol value, we can set 'code=2093-3'.

In [8]:

```
search2_url = root_url + "/Observation?patient=6430&code=2093-3"
```

To manage returned resources, we can use paramter `_sort` to define the order of results and use `_count` to define how many results should be displayed in a single page.

NOTE: In order to keep the load on clidents, servers and the network minimized, the server may choose to return the results in a series of pages. The search result contains the URLs that the client uses to request additional pages from the search set. **The monash FHIR server return results in a series of pages. Each page contains 10 results as default.** Each page contains a URL to the previous page(if not the first page) and the next page(if not the last page). In this case, we use '`_count=13`' to display all results(13 results) in one page.

NOTE: `_sort=date` indicates that results are displayed in increasing order according to the issued date. `_sort=-date` indicates that results are displayed in decreasing order.

In [9]:

```
search3_url= root_url + "/Observation?patient=6430&code=2093-3&_sort=date&_count=13"
```

In [10]:

```
data2 = requests.get(url=search3_url).json( )
```

In [11]:

```
data2
```

Out[11]:

```
{'resourceType': 'Bundle',
  'id': 'ad2fb812-754e-47c0-b953-3585ebb21a75',
  'meta': {'lastUpdated': '2020-02-12T00:13:23.269+11:00'},
  'type': 'searchset',
  'total': 13,
  'link': [{'relation': 'self',
    'url': 'http://hapi-fhir.erc.monash.edu:8080/baseDstu3//Observati
on?_count=13&_sort=date&code=2093-3&patient=6430'}]],
  'entry': [{'fullUrl': 'http://hapi-fhir.erc.monash.edu:8080/baseDst
u3/Observation/6586',
    'resource': {'resourceType': 'Observation',
      'id': '6586',
      'meta': {'versionId': '1', 'lastUpdated': '2019-05-01T11:41:19.9
50+10:00'},
      'status': 'final',
      'category': [{'coding': [{'system': 'http://hl7.org/fhir/observa
tion-category',
        'code': 'laboratory',
        'display': 'laboratory'}]}]],
      'code': {'coding': [{'system': 'http://loinc.org',
        'code': '2093-3',
        'display': 'Total Cholesterol'}]},
      'text': 'Total Cholesterol',
      'subject': {'reference': 'Patient/6430'},
      'context': {'reference': 'Encounter/6569'},
      'effectiveDateTime': '2009-05-25T19:50:54+00:00',
      'issued': '2009-05-25T19:50:54.401+00:00',
      'valueQuantity': {'value': 181.84335269125484,
        'unit': 'mg/dL',
        'system': 'http://unitsofmeasure.org',
        'code': 'mg/dL'}},
      'search': {'mode': 'match'}},
    {'fullUrl': 'http://hapi-fhir.erc.monash.edu:8080/baseDstu3/Observ
ation/6634',
      'resource': {'resourceType': 'Observation',
        'id': '6634',
        'meta': {'versionId': '1', 'lastUpdated': '2019-05-01T11:41:19.9
50+10:00'},
        'status': 'final',
        'category': [{'coding': [{'system': 'http://hl7.org/fhir/observa
tion-category',
          'code': 'laboratory',
          'display': 'laboratory'}]}]],
        'code': {'coding': [{'system': 'http://loinc.org',
          'code': '2093-3',
          'display': 'Total Cholesterol'}]},
        'text': 'Total Cholesterol',
        'subject': {'reference': 'Patient/6430'},
        'context': {'reference': 'Encounter/6617'},
        'effectiveDateTime': '2010-05-25T19:50:54+00:00',
        'issued': '2010-05-25T19:50:54.401+00:00',
        'valueQuantity': {'value': 164.570185399774,
          'unit': 'mg/dL',
          'system': 'http://unitsofmeasure.org',
          'code': 'mg/dL'}},
        'search': {'mode': 'match'}},
    {'fullUrl': 'http://hapi-fhir.erc.monash.edu:8080/baseDstu3/Observ
ation/6693',
      'resource': {'resourceType': 'Observation',
```

```

'id': '6693',
'meta': {'versionId': '1', 'lastUpdated': '2019-05-01T11:41:19.9
50+10:00'},
'status': 'final',
'category': [{'coding': [{'system': 'http://hl7.org/fhir/observa
tion-category',
'code': 'laboratory',
'display': 'laboratory'}]}],
'code': {'coding': [{'system': 'http://loinc.org',
'code': '2093-3',
'display': 'Total Cholesterol'}]},
'text': 'Total Cholesterol',
'subject': {'reference': 'Patient/6430'},
'context': {'reference': 'Encounter/6676'},
'effectiveDateTime': '2011-05-25T19:50:54+00:00',
'issued': '2011-05-25T19:50:54.401+00:00',
'valueQuantity': {'value': 152.8203982510682,
'unit': 'mg/dL',
'system': 'http://unitsofmeasure.org',
'code': 'mg/dL'}},
'search': {'mode': 'match'}},
{'fullUrl': 'http://hapi-fhir.erc.monash.edu:8080/baseDstu3/Observ
ation/6724',
'resource': {'resourceType': 'Observation',
'id': '6724',
'meta': {'versionId': '1', 'lastUpdated': '2019-05-01T11:41:19.9
50+10:00'},
'status': 'final',
'category': [{'coding': [{'system': 'http://hl7.org/fhir/observa
tion-category',
'code': 'laboratory',
'display': 'laboratory'}]}],
'code': {'coding': [{'system': 'http://loinc.org',
'code': '2093-3',
'display': 'Total Cholesterol'}]},
'text': 'Total Cholesterol',
'subject': {'reference': 'Patient/6430'},
'context': {'reference': 'Encounter/6710'},
'effectiveDateTime': '2011-12-03T19:50:54+00:00',
'issued': '2011-12-03T19:50:54.401+00:00',
'valueQuantity': {'value': 176.6062136941573,
'unit': 'mg/dL',
'system': 'http://unitsofmeasure.org',
'code': 'mg/dL'}},
'search': {'mode': 'match'}},
{'fullUrl': 'http://hapi-fhir.erc.monash.edu:8080/baseDstu3/Observ
ation/6752',
'resource': {'resourceType': 'Observation',
'id': '6752',
'meta': {'versionId': '1', 'lastUpdated': '2019-05-01T11:41:19.9
50+10:00'},
'status': 'final',
'category': [{'coding': [{'system': 'http://hl7.org/fhir/observa
tion-category',
'code': 'laboratory',
'display': 'laboratory'}]}],
'code': {'coding': [{'system': 'http://loinc.org',
'code': '2093-3',
'display': 'Total Cholesterol'}]},
'text': 'Total Cholesterol',
'subject': {'reference': 'Patient/6430'},

```



```

'context': {'reference': 'Encounter/6735'},
'effectiveDateTime': '2012-05-24T19:50:54+00:00',
'issued': '2012-05-24T19:50:54.401+00:00',
'valueQuantity': {'value': 174.4016122465251,
'unit': 'mg/dL',
'system': 'http://unitsofmeasure.org',
'code': 'mg/dL'}},
'search': {'mode': 'match'}},
{'fullUrl': 'http://hapi-fhir.erc.monash.edu:8080/baseDstu3/Observation/6799',
'resource': {'resourceType': 'Observation',
'id': '6799',
'meta': {'versionId': '1', 'lastUpdated': '2019-05-01T11:41:19.950+10:00'},
'status': 'final',
'category': [{'coding': [{'system': 'http://hl7.org/fhir/observation-category',
'code': 'laboratory',
'display': 'laboratory'}]}]},
'code': {'coding': [{'system': 'http://loinc.org',
'code': '2093-3',
'display': 'Total Cholesterol'}]},
'text': 'Total Cholesterol'},
'subject': {'reference': 'Patient/6430'},
'context': {'reference': 'Encounter/6782'},
'effectiveDateTime': '2013-05-24T19:50:54+00:00',
'issued': '2013-05-24T19:50:54.401+00:00',
'valueQuantity': {'value': 159.35069384982023,
'unit': 'mg/dL',
'system': 'http://unitsofmeasure.org',
'code': 'mg/dL'}},
'search': {'mode': 'match'}},
{'fullUrl': 'http://hapi-fhir.erc.monash.edu:8080/baseDstu3/Observation/6846',
'resource': {'resourceType': 'Observation',
'id': '6846',
'meta': {'versionId': '1', 'lastUpdated': '2019-05-01T11:41:19.950+10:00'},
'status': 'final',
'category': [{'coding': [{'system': 'http://hl7.org/fhir/observation-category',
'code': 'laboratory',
'display': 'laboratory'}]}]},
'code': {'coding': [{'system': 'http://loinc.org',
'code': '2093-3',
'display': 'Total Cholesterol'}]},
'text': 'Total Cholesterol'},
'subject': {'reference': 'Patient/6430'},
'context': {'reference': 'Encounter/6829'},
'effectiveDateTime': '2014-05-24T19:50:54+00:00',
'issued': '2014-05-24T19:50:54.401+00:00',
'valueQuantity': {'value': 152.01733803380867,
'unit': 'mg/dL',
'system': 'http://unitsofmeasure.org',
'code': 'mg/dL'}},
'search': {'mode': 'match'}},
{'fullUrl': 'http://hapi-fhir.erc.monash.edu:8080/baseDstu3/Observation/6870',
'resource': {'resourceType': 'Observation',
'id': '6870',
'meta': {'versionId': '1', 'lastUpdated': '2019-05-01T11:41:19.9

```

```

50+10:00'},
  'status': 'final',
  'category': [{'coding': [{'system': 'http://hl7.org/fhir/observa
tion-category',
    'code': 'laboratory',
    'display': 'laboratory'}]}]},
  'code': {'coding': [{'system': 'http://loinc.org',
    'code': '2093-3',
    'display': 'Total Cholesterol'}]},
  'text': 'Total Cholesterol',
  'subject': {'reference': 'Patient/6430'},
  'context': {'reference': 'Encounter/6856'},
  'effectiveDateTime': '2014-12-20T19:50:54+00:00',
  'issued': '2014-12-20T19:50:54.401+00:00',
  'valueQuantity': {'value': 172.52513738574945,
    'unit': 'mg/dL',
    'system': 'http://unitsofmeasure.org',
    'code': 'mg/dL'}},
  'search': {'mode': 'match'}},
{'fullUrl': 'http://hapi-fhir.erc.monash.edu:8080/baseDstu3/Observ
ation/6899',
  'resource': {'resourceType': 'Observation',
    'id': '6899',
    'meta': {'versionId': '1', 'lastUpdated': '2019-05-01T11:41:19.9
50+10:00'},
    'status': 'final',
    'category': [{'coding': [{'system': 'http://hl7.org/fhir/observa
tion-category',
      'code': 'laboratory',
      'display': 'laboratory'}]}]},
    'code': {'coding': [{'system': 'http://loinc.org',
      'code': '2093-3',
      'display': 'Total Cholesterol'}]},
    'text': 'Total Cholesterol',
    'subject': {'reference': 'Patient/6430'},
    'context': {'reference': 'Encounter/6882'},
    'effectiveDateTime': '2015-05-24T19:50:54+00:00',
    'issued': '2015-05-24T19:50:54.401+00:00',
    'valueQuantity': {'value': 187.0985945320882,
      'unit': 'mg/dL',
      'system': 'http://unitsofmeasure.org',
      'code': 'mg/dL'}},
    'search': {'mode': 'match'}},
{'fullUrl': 'http://hapi-fhir.erc.monash.edu:8080/baseDstu3/Observ
ation/6958',
  'resource': {'resourceType': 'Observation',
    'id': '6958',
    'meta': {'versionId': '1', 'lastUpdated': '2019-05-01T11:41:19.9
50+10:00'},
    'status': 'final',
    'category': [{'coding': [{'system': 'http://hl7.org/fhir/observa
tion-category',
      'code': 'laboratory',
      'display': 'laboratory'}]}]},
    'code': {'coding': [{'system': 'http://loinc.org',
      'code': '2093-3',
      'display': 'Total Cholesterol'}]},
    'text': 'Total Cholesterol',
    'subject': {'reference': 'Patient/6430'},
    'context': {'reference': 'Encounter/6941'},
    'effectiveDateTime': '2016-05-23T19:50:54+00:00',

```

```

    'issued': '2016-05-23T19:50:54.401+00:00',
    'valueQuantity': {'value': 158.0543798990897,
    'unit': 'mg/dL',
    'system': 'http://unitsofmeasure.org',
    'code': 'mg/dL'}},
    'search': {'mode': 'match'}},
    {'fullUrl': 'http://hapi-fhir.erc.monash.edu:8080/baseDstu3/Observation/7006',
    'resource': {'resourceType': 'Observation',
    'id': '7006',
    'meta': {'versionId': '1', 'lastUpdated': '2019-05-01T11:41:19.950+10:00'},
    'status': 'final',
    'category': [{'coding': [{'system': 'http://hl7.org/fhir/observation-category',
    'code': 'laboratory',
    'display': 'laboratory'}]}]},
    'code': {'coding': [{'system': 'http://loinc.org',
    'code': '2093-3',
    'display': 'Total Cholesterol'}]},
    'text': 'Total Cholesterol',
    'subject': {'reference': 'Patient/6430'},
    'context': {'reference': 'Encounter/6989'},
    'effectiveDateTime': '2017-05-23T19:50:54+00:00',
    'issued': '2017-05-23T19:50:54.401+00:00',
    'valueQuantity': {'value': 165.45380208309686,
    'unit': 'mg/dL',
    'system': 'http://unitsofmeasure.org',
    'code': 'mg/dL'}},
    'search': {'mode': 'match'}},
    {'fullUrl': 'http://hapi-fhir.erc.monash.edu:8080/baseDstu3/Observation/7030',
    'resource': {'resourceType': 'Observation',
    'id': '7030',
    'meta': {'versionId': '1', 'lastUpdated': '2019-05-01T11:41:19.950+10:00'},
    'status': 'final',
    'category': [{'coding': [{'system': 'http://hl7.org/fhir/observation-category',
    'code': 'laboratory',
    'display': 'laboratory'}]}]},
    'code': {'coding': [{'system': 'http://loinc.org',
    'code': '2093-3',
    'display': 'Total Cholesterol'}]},
    'text': 'Total Cholesterol',
    'subject': {'reference': 'Patient/6430'},
    'context': {'reference': 'Encounter/7016'},
    'effectiveDateTime': '2018-01-06T19:50:54+00:00',
    'issued': '2018-01-06T19:50:54.401+00:00',
    'valueQuantity': {'value': 181.2671549090955,
    'unit': 'mg/dL',
    'system': 'http://unitsofmeasure.org',
    'code': 'mg/dL'}},
    'search': {'mode': 'match'}},
    {'fullUrl': 'http://hapi-fhir.erc.monash.edu:8080/baseDstu3/Observation/7059',
    'resource': {'resourceType': 'Observation',
    'id': '7059',
    'meta': {'versionId': '1', 'lastUpdated': '2019-05-01T11:41:19.950+10:00'},
    'status': 'final',

```

```

'category': [{'coding': [{'system': 'http://hl7.org/fhir/observa
tion-category',
    'code': 'laboratory',
    'display': 'laboratory'}]}],
'code': {'coding': [{'system': 'http://loinc.org',
    'code': '2093-3',
    'display': 'Total Cholesterol'}]},
'text': 'Total Cholesterol',
'subject': {'reference': 'Patient/6430'},
'context': {'reference': 'Encounter/7042'},
'effectiveDateTime': '2018-05-23T19:50:54+00:00',
'issued': '2018-05-23T19:50:54.401+00:00',
'valueQuantity': {'value': 170.99584598077593,
    'unit': 'mg/dL',
    'system': 'http://unitsofmeasure.org',
    'code': 'mg/dL'}},
'search': {'mode': 'match'}}}]

```

## Extract data from json data in python

Json consists of attribute-value pairs and arrays. The above **data2** includes 7 attribute-value pairs: **resourceType**, **id**, **meta**, **type**, **total**, **link**, **entry**. Set the attribute name using square brackets, then we can get the corresponding value. `data2['entry']` gives an array in this case.

In [12]:

```
entry=data2['entry']
```

In [13]:

```
len(entry)
```

Out[13]:

13

In [14]:

```
Cholesterol_data = pd.DataFrame(columns =['cholesterol', 'issued'] )
```

In [15]:

```

for i in range(len(entry)):
    record=[]
    item = entry[i]['resource']
    weight = item['valueQuantity']['value']
    issued = item['issued']
    record.append(weight)
    record.append(issued)
    Cholesterol_data.loc[i] = record

```

In [16]:

Cholesterol\_data

Out[16]:

	cholesterol	issued
0	181.843353	2009-05-25T19:50:54.401+00:00
1	164.570185	2010-05-25T19:50:54.401+00:00
2	152.820398	2011-05-25T19:50:54.401+00:00
3	176.606214	2011-12-03T19:50:54.401+00:00
4	174.401612	2012-05-24T19:50:54.401+00:00
5	159.350694	2013-05-24T19:50:54.401+00:00
6	152.017338	2014-05-24T19:50:54.401+00:00
7	172.525137	2014-12-20T19:50:54.401+00:00
8	187.098595	2015-05-24T19:50:54.401+00:00
9	158.054380	2016-05-23T19:50:54.401+00:00
10	165.453802	2017-05-23T19:50:54.401+00:00
11	181.267155	2018-01-06T19:50:54.401+00:00
12	170.995846	2018-05-23T19:50:54.401+00:00

## Example 3

In this example, Urls under 'link' attribute is used to load additional results. (As discussed above, the server will only return a single page with at most 10 records.)

All patients' cholesterol values(if they are measured) as well as their basic information are recorded.

In [25]:

dReport\_url= root\_url +"/DiagnosticReport"

In [26]:

```
data3 = pd.DataFrame(columns =['patientid','gender', 'birthDate', 'maritalStatus', 'totalCholesterol',"Triglycerides", 'lowDensity', 'highDensity', 'issued']
)
```

In [27]:

```
def checkFunc(patient_id,new_date):  
    # check whether the observation's issued date is the latest  
    if patient_id not in data3.index:  
        return True  
    else:  
        old_date = data3.loc[patient_id,'issued']  
        if new_date > old_date:  
            data3.drop([patient_id])  
            return True  
        else:  
            return False
```

In [30]:

```

next_page = True
next_url = dReport_url
count_page = 0
count_patient = 0

while next_page == True:
    dReports = requests.get(url=next_url).json()

    # As discussed before, The monash FHIR server return results in a series of
    # pages.
    # Each page contains 10 results as default.
    # here we check and record the next page
    next_page = False
    links = dReports['link']
    for i in range(len(links)):
        link=links[i]
        if link['relation'] == 'next':
            next_page = True
            next_url = link['url']
            count_page += 1

    # Extract data
    entry = dReports['entry']
    for i in range(len(entry)):
        patient_array = []
        results = entry[i]['resource']['result']

        # Check whether this observation is on cholesterol or not.
        cholesterol = False
        for result in results:
            if result['display'] == 'Total Cholesterol':
                cholesterol = True

        # If this observation is on cholesterol value, then record the patient's
        # id and issued date.
        if cholesterol == True:
            patient_id = entry[i]['resource']['subject']['reference'][len('Patient/'):]

            issued = entry[i]['resource']['issued'][:len('2011-02-11')]
            date = datetime.strptime(issued, '%Y-%m-%d').date()

            # Get patient's basic information
            patient_data = requests.get(url = root_url+'Patient/'+patient_id).json()

            gender = patient_data['gender']
            birth = patient_data['birthDate']
            birthDate = datetime.strptime(birth, '%Y-%m-%d').date()
            maritalStatus = patient_data['maritalStatus']['text']

            check = checkFunc(patient_id,date)

            # Check if the patient's Cholesterol value has already been recorded
            # in the dataframe
            if check == True:
                count_patient+=1
                patient_array.append(patient_id)
                patient_array.append(gender)
                patient_array.append(birthDate)
                patient_array.append(maritalStatus)

```

```

        # Record cholestoral(including total, Triglycerides, lowDensity
        and highDensity) value
        for result in results:
            observation_ref = result['reference']
            observation_data = requests.get(url = root_url + observation
_ref).json()

            value = observation_data['valueQuantity']['value']
            patient_array.append(value)
            patient_array.append(date)
            data3.loc[patient_id] = patient_array

```

In [32]:

```
data3
```

Out[32]:

	patientid	gender	birthDate	maritalStatus	totalCholesterol	Triglycerides	lowDensity
<b>9380</b>	9380	male	1966-02-06	M	234.841260	157.560469	150.083612
<b>3839</b>	3839	female	1965-03-26	M	195.771682	103.065685	102.807054
<b>11494</b>	11494	male	1979-08-05	S	184.541283	143.131479	84.012090
<b>11593</b>	11593	female	1949-08-25	M	173.780583	113.200113	77.077567
<b>11789</b>	11789	male	1972-06-03	M	177.841265	132.329067	84.475302
...	...	...	...	...	...	...	...
<b>183435</b>	183435	male	1968-05-29	S	172.870334	129.993021	87.863992
<b>183858</b>	183858	female	1945-12-06	M	199.186953	120.282613	110.374032
<b>184563</b>	184563	female	1949-12-13	M	197.060743	122.440751	101.558910
<b>185273</b>	185273	male	1974-01-20	M	193.240322	127.538518	98.847097
<b>148699</b>	148699	female	1908-11-26	M	181.312840	100.652043	97.585912

306 rows × 9 columns

References(Good to look at): <https://fhir-drills.github.io/simple-patient.html> (<https://fhir-drills.github.io/simple-patient.html>)  
<https://www.hl7.org/fhir/search.html> (<https://www.hl7.org/fhir/search.html>)