PS4 Extract and Post Data

The Semantics Squad (Group 7)

Eswar Kamisetti, Ramya Keerthi Majji, Keerthika Sunchu,

April Taylor, Vaibhav Thakur

IUI Luddy School of Informatics, Computing, and Engineering

INFO B581: Health Information Standards & Terminologies

Dr. Saptarshi Purkayastha

April 21, 2024

PS2 Extract and Post Data

Sprint 4 focuses on the entire interoperability pathway for an electronic prescription. The customized C-CDA document from Sprint 3 was converted with XSLT to create relevant data in OpenMRS (sender). Then prescription orders were created in OpenMRS and submitted to Surescripts for transmission to any pharmacy for medication dispensing.

Use Case

"A male patient aged 65 years consulted a clinician with the chief complaints of headache and has been diagnosed with hypertension. He had no past medical or medication history. He is a chronic smoker for 10 years and non-alcoholic. Also, had a family history of diabetes mellitus and hypertension. Physical examination was found to be normal. The patient has been prescribed Atenolol 50mg, Telmisartan 40mg. All information was updated in the electronic health records. Surescripts should be generated from EHR and sent to pharmacy network for dispensing."

Methods

OpenMRS

Interchange Format and Representation

System A, OpenMRS for this use case, is an electronic health record (EHR) which the clinician enters patient information and creates orders for treatments and medications. System A utilizes an EHR format to store patient health information. This format typically includes structured data fields for various aspects of the patient's medical history, including demographics, medical conditions, medications, allergies, and laboratory results (Benson & Grieve, 2021, pp. 383-384). In this specific use case, the EHR contains structured data fields such as patient demographics (age, gender), medical history (hypertension, smoking history, family history), current medications (Atenolol 50mg,

Telmisartan 40mg), and clinical notes (chief complaints, and physical examination findings). The data in the EHR is represented using standard medical terminologies such as SNOMED CT for diagnoses and RxNorm for medications (Benson & Grieve, 2021, pp. 383-384)

Relevant CDA sections

2. Patient Encounter with Patient Information in New Visit

Encounter details provide essential demographic data and other details about the patient in a standardized format. In this use case, it was necessary to update System A (OpenMRS) with the details of the encounter that happened when the patient visited the clinician with a chief complaint of a headache. The encounter section contains the patient details, physician details, healthcare facility, the date and time of encounter, type of encounter, family history, social history and a diagnosis of hypertension. To retrieve the details, the sections from the Clinical Document Architecture (CDA) extracted with XSLT were 'encounter,' 'Patient Chart Summary,' 'Problem List,' 'Family History,' 'Social History' based on OpenMRS sections (See Appendix 1). This consistency and standard allow data to be transmitted to System A (OpenMRS) according to their standard format and understand the information in an effective way without misinterpretations and errors. The standard interchange format utilized by OpenMRS is JSON.

2. Physical Examination & Vitals

The main part of the patient record includes vitals, physical examination, and other diagnostic findings. We used the Physical Examination and Vitals section from our CDA document to create this stylesheet. With standardization of the observation transmission and display, interoperability between different systems can be enhanced.

2. Medications

Medical records include records of past and current medications used by the patient. This record allows for consistency of medication management across different care settings. The medication section from the CDA was extracted and the OpenMRS observation were used to create an XSLT to extract this section. Updated medication lists are crucial for avoiding drug interactions and duplications. Sharing medication information across systems in a compliant and secure manner adheres to healthcare regulations about patient safety and privacy.

Surescripts

Interchange Format and Representation

System B refers to the pharmacy network system where the prescription is sent, using SureScripts, for dispensing. The interchange format used for transmitting prescription information between System A (EHR) and System B (Pharmacy Network) may vary depending on the specific protocols and standards implemented by the healthcare organization. Common interchange formats for prescription data transmission include Health Level Seven International (HL7) messages, specifically the HL7 version 2.x standards such as HL7 v2.5.1 (Benson & Grieve, 2021, p. 224). These messages encode information about the prescription, including the patient's demographics, prescribed medications (including dosage and frequency), prescriber information, and any relevant clinical notes (Benson & Grieve, 2021, p. 224). The data transmitted may also adhere to standards like NCPDP (National Council for Prescription Drug Programs) SCRIPT Standard for ePrescribing (Benson & Grieve, 2016, p. 108). System A for this use case follows the NCPDP standards which utilizes a XML interchange format. The representation of prescription data in the pharmacy network system is typically structured to facilitate accurate dispensing and may be stored in a pharmacy information system using database schemas tailored to pharmacy operations (Benson & Grieve, 2016, p. 252).

Relevant sections

1. Patient information

   Patient details are being sent to the pharmacy to ensure the correct patient receives the correct medication.

2. Medication order

   A prescription order was extracted from the CDA in an XML format according to NCPDP standards. SureScripts software accepts XML format, hence the output for the extracted sections are XML format (See Appendix 2).

Conclusion

The focus of this sprint was to bring the work done on the CDA to customize it for the use case to the process of extracting data in order to prepare to post from one system to another. Once this project sprint is completed, the team is near completion of demonstrating full interoperability.

Appendix 1 System A

Patient Encounter with Patient Information in New Visit

Creating a new Encounter for a new Visit / Create a Person (OpenMRS Format)

```
POST /person
{
   "names": [
      {
      "givenName": "Mohit",
      "familyName": "Kumar"
      }
   ],
   "gender": "M",
   "birthdate": "1997-09-02",
   "addresses": [
      {
      "address1": "30, Vivekananda Layout, Munnekolal,Marathahalli",
      "cityVillage": "Bengaluru",
      "country": "India",
      "postalCode": "560037"
      }
   ]
}
POST /Encounter
{
   "encounterDatetime": "2015-02-24T06:08:25.000+0000",
   "patient": "96be32d2-9367-4d1d-a285-79a5e5db12b8",
   "encounterType": "67a71486-1a54-468f-ac3e-7091a9a79584",
   "location": "58c57d25-8d39-41ab-8422-108a0c277d98",
   "encounterProviders": [
      {
         "provider": "bb1a7781-7896-40be-aaca-7d1b41d843a6",
         "encounterRole": "240b26f9-dd88-4172-823d-4a8bfeb7841f"
      }
   ],
   "visit": {
      "patient": "96be32d2-9367-4d1d-a285-79a5e5db12b8",
      "visitType": "7b0f5697-27e3-40c4-8bae-f4049abfb4ed",
      "startDatetime": "2015-02-24T06:08:25.000+0000",
      "stopDatetime" : "2015-02-24T06:09:25.000+0000"
   }
}
```

XSLT XML :

```
 <?xml version="1.0" encoding="UTF-8"?>
<xsl:stylesheet version="1.0" xmlns:xsl="http://www.w3.org/1999/XSL/Transform"
   xmlns:cda="urn:hl7-org:v3" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
   <xsl:output method="text"/>

   <xsl:template match="/">
      <xsl:variable name="patient" select="//cda:recordTarget/cda:patientRole/cda:patient"/>
      <xsl:variable name="address" select="//cda:recordTarget/cda:patientRole/cda:addr"/>
      <!-- extracting birthTime -->
      <xsl:variable name="birthYear" select="substring($patient/cda:birthTime/@value, 1, 4)"/>
      <xsl:variable name="birthMonth" select="substring($patient/cda:birthTime/@value, 5, 2)"/>
      <xsl:variable name="birthDay" select="substring($patient/cda:birthTime/@value, 7, 2)"/>
      <!-- Construct the birthdate in the desired format -->
      <xsl:variable name="birthdate" select="concat($birthYear, '-', $birthMonth, '-', $birthDay)"/>
      <!-- Use $birthdate for YYYY-MM-DD format -->
      <xsl:variable name="dateYear"
         select="substring(//cda:encounter/cda:effectiveTime/@value, 1, 4)"/>
      <xsl:variable name="dateMonth"
         select="substring(//cda:encounter/cda:effectiveTime/@value, 5, 2)"/>
      <xsl:variable name="dateDay"
         select="substring(//cda:encounter/cda:effectiveTime/@value, 7, 2)"/>
      <xsl:variable name="dateTime"
         select="substring(//cda:encounter/cda:effectiveTime/@value, 9, 2)"/>
      <xsl:variable name="dateSeconds1"
         select="substring(//cda:encounter/cda:effectiveTime/@value, 11, 2)"/>
      <xsl:variable name="dateSeconds2"
         select="substring(//cda:encounter/cda:effectiveTime/@value, 13, 2)"/>
      <xsl:variable name="dateFormat"
         select="concat($dateYear, '-', $dateMonth, '-', $dateDay, 'T', $dateTime, ':', $dateSeconds1, ':',
$dateSeconds2, '.000+0000')"/>
      <xsl:text>{&#xA;</xsl:text>
      <xsl:text>  "patient": {&#xA;</xsl:text>
      <xsl:text>    "names": [&#xA;</xsl:text>
      <xsl:text>      {&#xA;</xsl:text>
      <xsl:text>        "givenName": "</xsl:text>
      <xsl:value-of select="$patient/cda:name/cda:given"/>
      <xsl:text>",&#xA;</xsl:text>
      <xsl:text>        "familyName": "</xsl:text>
      <xsl:value-of select="$patient/cda:name/cda:family"/>
      <xsl:text>"&#xA;</xsl:text>
      <xsl:text>      }&#xA;</xsl:text>
      <xsl:text>    ],&#xA;</xsl:text>
      <xsl:text>    "gender": "</xsl:text>
      <xsl:value-of select="$patient/cda:administrativeGenderCode/@code"/>
```

```
        <xsl:text>",&#xA;</xsl:text>
        <xsl:text>    "birthdate": "</xsl:text>
        <xsl:value-of select="$birthdate"/>
        <xsl:text>",&#xA;</xsl:text>
        <xsl:text>    "addresses": [&#xA;</xsl:text>
        <xsl:text>      {&#xA;</xsl:text>
        <xsl:text>        "address1": "</xsl:text>
        <xsl:value-of select="$address/cda:streetAddressLine"/>
        <xsl:text>",&#xA;</xsl:text>
        <xsl:text>        "cityVillage": "</xsl:text>
        <xsl:value-of select="$address/cda:city"/>
        <xsl:text>",&#xA;</xsl:text>
        <xsl:text>        "country": "</xsl:text>
        <xsl:value-of select="$address/cda:country"/>
        <xsl:text>",&#xA;</xsl:text>
        <xsl:text>        "postalCode": "</xsl:text>
        <xsl:value-of select="$address/cda:postalCode"/>
        <xsl:text>"&#xA;</xsl:text>
        <xsl:text>      }&#xA;</xsl:text>
        <xsl:text>    ]&#xA;</xsl:text>
        <xsl:text>  },&#xA;</xsl:text>
        <!-- Creating a new Encounter for a new Visit -->
        <xsl:text>{&#xA;</xsl:text>
        <xsl:text>  "encounterDatetime": "</xsl:text>
        <xsl:value-of select="//cda:encounter/cda:effectiveTime/@value"/>
        <xsl:text>",&#xA;</xsl:text>
        <xsl:text>  "patient": "</xsl:text>
        <xsl:value-of select="//cda:recordTarget/cda:patientRole/cda:id/@root"/>
        <xsl:text>",&#xA;</xsl:text>
        <xsl:text>  "encounterType": "</xsl:text>
        <xsl:value-of select="//cda:entry[1]/cda:encounter[1]/@classCode"/>
        <xsl:text>",&#xA;</xsl:text>
        <xsl:text>  "location": "</xsl:text>
        <xsl:value-of select="//cda:encounter/cda:participant/cda:participantRole/cda:addr/cda:city"/>
        <xsl:text>",&#xA;</xsl:text>
        <xsl:text>  "encounterProviders": [&#xA;</xsl:text>
        <xsl:text>    {&#xA;</xsl:text>
        <xsl:text>      "provider": "</xsl:text>
        <xsl:value-of select="//cda:encounter/cda:performer/cda:assignedEntity/cda:id/@extension"/>
        <xsl:text>",&#xA;</xsl:text>
        <xsl:text>      "encounterRole": "</xsl:text>
        <xsl:value-of
    select="//cda:documentationOf/serviceEvent/performer/functionCode/@codeSystem"/>
        <xsl:text>",&#xA;</xsl:text>
        <xsl:text>    }&#xA;</xsl:text>
        <xsl:text>  ],&#xA;</xsl:text>
```

```
<xsl:text>  "visit": {&#xA;</xsl:text>
<xsl:text>    "patient": "</xsl:text>
<xsl:value-of select="//cda:recordTarget/cda:patientRole/cda:id/@root"/>
<xsl:text>",&#xA;</xsl:text>
<xsl:text>    "visitType": </xsl:text>
<xsl:value-of select="//cda:entry/cda:encounter/cda:code/@code"/>
<xsl:text>",&#xA;</xsl:text>
<xsl:text>    "startDatetime": "</xsl:text>
<xsl:value-of select="$dateFormat"/>
<xsl:text>",&#xA;</xsl:text>
<xsl:text>    "stopDatetime" : "</xsl:text>
<xsl:value-of select="$dateFormat"/>
<xsl:text>"&#xA;</xsl:text>
<xsl:text>  }&#xA;</xsl:text>
<xsl:text>}</xsl:text>

<!-- Cheif Complaint in problem list during the ecounter -->

<xsl:variable name="Problemlist" select="//cda:component/cda:section[cda:templateId/@root =
'2.16.840.1.113883.10.20.22.2.5.1']"/>
<xsl:variable name="Problem1"
   select="$Problemlist/cda:act[cda:entryRelationship/cda:observation/cda:code/@code=
'R51.9']"/>/>
{
<xsl:text>  "person": "</xsl:text>
<xsl:value-of select="//cda:recordTarget/cda:patientRole/cda:id/@root"/>
<xsl:text>",&#xA;</xsl:text>
"concept": <xsl:value-of
select="$Problem1/cda:entryRelationship/cda:observation/cda:code/@codeSystemName"/>
<xsl:text>",&#xA;</xsl:text>
<xsl:text>    "obsDatetime": "</xsl:text>
<xsl:value-of select="$dateFormat"/>
"value":<xsl:value-of
select="$Problem1/cda:entryRelationship/cda:observation/cda:code/@displayName"/>"
}



<!-- Family History -->

<xsl:variable name="History"
   select="//cda:component/cda:section[cda:templateId/@root =
'2.16.840.1.113883.10.20.22.2.15']"/>
<xsl:variable name="FamilyHistory1"
   select="$History/cda:entry/cda:organizer/cda:component[cda:observation/cda:value/@code =
'E08']"/>/>
```

```
<xsl:variable name="History2"
   select="//cda:component/cda:section[cda:templateId/@root =
'2.16.840.1.113883.10.20.22.2.15']"/>
<xsl:variable name="FamilyHistory2"
   select="$History2/cda:entry/cda:organizer/cda:component[cda:observation/cda:value/@code =
'I10']"/>/
{
"Name": <xsl:value-of select="$FamilyHistory1/cda:observation/cda:value/@displayName"/>
"Description": "Has_Family_History_of_Diabeties_Mellitus"/>
"Name": <xsl:value-of select="$FamilyHistory2/cda:observation/cda:value/@displayName"/>
"Description": "Has_Family_History_of_Hypertension"/>

}

<!-- Habit History -->
<xsl:variable name="SocialHistory"
   select="//cda:component/cda:section[cda:templateId/@root =
'2.16.840.1.113883.10.20.22.2.17']"/>
<xsl:variable name="Smokinghistory"
   select="$SocialHistory/cda:entry/cda:observation[cda:code/@code = '72166-2']"/>/>
<xsl:variable name="Smokinghistorystatus"
   select="$SocialHistory/cda:entry/cda:observation[cda:value/@code = 'F17.219']"/>/>
<xsl:variable name="Alcoholhistory"
   select="$SocialHistory/cda:entry/cda:observation[cda:code/@code = '74205-6']"/>/>
<xsl:variable name="Alcoholhistorystatus"
   select="$SocialHistory/cda:entry/cda:observation[cda:value/@code = '443315005']"/>/>
{
"Name": <xsl:value-of select="$Smokinghistory/cda:code/@displayName"/>
"Description": <xsl:value-of select="$Smokinghistorystatus/cda:value/@displayName"/>
"Name": <xsl:value-of select="$Alcoholhistory/cda:code/@displayName"/>
"Description": <xsl:value-of select="$Alcoholhistorystatus/cda:value/@displayName"/>
}

<!-- Diagnosis during the encounter -->
<xsl:variable name="DiagnosisEncounter"
   select="//cda:component/cda:section[cda:templateId/@root =
'2.16.840.1.113883.10.20.22.2.22.1']"/>
<xsl:variable name="Diagnosis"

select="$DiagnosisEncounter/cda:entry/cda:encounter[cda:entryRelationship/cda:act/cda:code/@code
System = '2.16.840.1.113883.6.90']"
/>/> { <xsl:text>  "person": "</xsl:text>
<xsl:value-of select="//cda:recordTarget/cda:patientRole/cda:id/@root"/>
<xsl:text>",&#xA;</xsl:text>
"concept": <xsl:value-of
select="$Diagnosis/cda:entryRelationship/cda:act/cda:code/@codeSystemName"/>
```

```
        <xsl:text>",&#xA;</xsl:text>
        <xsl:text>    "obsDatetime": "</xsl:text>
        <xsl:value-of select="$dateFormat"/>
        "value":<xsl:value-of
select="$Diagnosis/cda:entryRelationship/cda:act/cda:code/@displayName"/>"

/default:ClinicalDocument/default:component[1]/default:structuredBody[1]/default:component[3]/defa
ult:section[1]/default:entry[1]/default:encounter[1]/default:entryRelationship[1]/default:act[1]/default:
code[1]/@codeSystem
        }
    </xsl:template>
</xsl:stylesheet>
```

JSON Output:

```
{
 "patient": {
  "names": [
   {
    "givenName": "Josh",
    "familyName": "Patel"
   }
  ],
  "gender": "M",
  "birthdate": "1959-05-01",
  "addresses": [
   {
    "address1": "2024 Indiana Ave",
    "cityVillage": "Indidanapolis",
    "country": "US",
    "postalCode": "46202"
   }
  ]
 },
{
 "encounterDatetime": "2024031000-0800",
 "patient": "2.16.840.1.113883.4.1",
 "encounterType": "ENC",
 "location": "Indianapolis",
 "encounterProviders": [
  {
   "provider": "1073761763",
   "encounterRole": "",
  }
```

```
 ],
 "visit": {
  "patient": "2.16.840.1.113883.4.1",
  "visitType": 99242",
  "startDatetime": "2024-03-10T00:-0:80.000+0000",
  "stopDatetime" : "2024-03-10T00:-0:80.000+0000"
 }
}/>
     {
       "person": "2.16.840.1.113883.4.1",

      "concept": ICD-10-CM",
  "obsDatetime": "2024-03-10T00:-0:80.000+0000
      "value":Headache"
      }




      />
      /
      {
      "Name": Diabetes Mellitus
      "Description": "Has_Family_History_of_Diabeties_Mellitus"/>
      "Name": Hypertension
      "Description": "Has_Family_History_of_Hypertension"/>

     }


      />
      />
      />
      />
      {
      "Name": Tobacco smoking status NHIS
      "Description": Chronic Smoker
      "Name": Alcohol use
      "Description": Non-alcoholic
      }


      /> {   "person": "2.16.840.1.113883.4.1",

      "concept": ICD-10-CM",
```

"obsDatetime": "2024-03-10T00:-0:80.000+0000
"value":Hypertension"

}

Visit Observation—Vital Signs and Physical Exam

Create an observation (OpenMRS Format)

```
POST /obs
{
  "person": "070f0120-0283-4858-885d-a20d967729cf",
  "concept": "5089AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA",
  "obsDatetime": "2019-11-14T07:37:31.000+0000",
  "value": 70
}
```

XSLT XML

```
<?xml version="1.0" encoding="UTF-8"?>
<xsl:stylesheet version="1.0"
    xmlns:xsl="http://www.w3.org/1999/XSL/Transform"
    xmlns:cda="urn:hl7-org:v3"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <xsl:output method="text" encoding="UTF-8"/>

    <!-- Match the root element of the document -->
    <xsl:template match="/">
        <xsl:text>[&#xA;</xsl:text>
        <!-- Apply templates to extract vital signs -->
        <xsl:apply-templates

select="//cda:component//cda:section//cda:entry//cda:organizer//cda:component//cda:observation"/>
        <xsl:text>]&#xA;</xsl:text>

        <!-- Extract physical exam -->
        <xsl:apply-templates select="//cda:section[cda:code/@code='29545-1']"/>
    </xsl:template>

    <!--Create Data Format of the document -->
    <xsl:variable name="dateYear" select="substring(//cda:encounter//cda:effectiveTime/@value, 1,
4)"/>
    <xsl:variable name="dateMonth" select="substring(//cda:encounter//cda:effectiveTime/@value, 5,
2)"/>
    <xsl:variable name="dateDay" select="substring(//cda:encounter//cda:effectiveTime/@value, 7,
2)"/>
    <xsl:variable name="dateTime" select="substring(//cda:encounter//cda:effectiveTime/@value, 9,
2)"/>
    <xsl:variable name="dateSeconds1" select="substring(//cda:encounter//cda:effectiveTime/@value,
11, 2)"/>
```

```
   <xsl:variable name="dateSeconds2" select="substring(//cda:encounter//cda:effectiveTime/@value,
13, 2)"/>
   <xsl:variable name="dateFormat"
      select="concat($dateYear, '-', $dateMonth, '-', $dateDay, 'T', $dateTime, ':', $dateSeconds1, ':',
$dateSeconds2, '.000+0000')"/>

   <!-- Match observation elements -->
   <xsl:template match="cda:observation">
      <!-- Check if the observation is for blood pressure, height, or weight -->
      <xsl:choose>
         <xsl:when test="cda:code/@code = '8480-6' or cda:code/@code = '8462-4' or cda:code/@code
= '8302-2'">
            <xsl:text>{&#xA;</xsl:text>
            <!-- Extract information -->
            <xsl:text>  "person": "</xsl:text>
            <xsl:value-of select="//cda:recordTarget//cda:patientRole//cda:id/@root"/>
            <xsl:text>",&#xA;</xsl:text>
            <xsl:text>  "concept": "</xsl:text>
            <xsl:value-of select="cda:code/@code"/>
            <xsl:text>",&#xA;</xsl:text>
            <xsl:text>  "obsDatetime": "</xsl:text>
            <xsl:value-of select="$dateFormat"/>
            <xsl:text>",&#xA;</xsl:text>
            <xsl:text>  "value": "</xsl:text>
            <xsl:value-of select="cda:value/@value"/>
            <xsl:text>"&#xA;</xsl:text>
            <xsl:text>}</xsl:text>
            <!-- Add comma if not the last observation -->
            <xsl:if test="position() != last()">,</xsl:if>
            <xsl:text>&#xA;</xsl:text>
         </xsl:when>
      </xsl:choose>
   </xsl:template>

   <!-- Match the physical exam section -->
   <xsl:template match="cda:section[cda:code/@code='29545-1']">
      <xsl:text>{&#xA;</xsl:text>
      <xsl:text>  "person": "</xsl:text>
      <xsl:value-of select="//cda:recordTarget//cda:patientRole//cda:id/@root"/>
      <xsl:text>",&#xA;</xsl:text>
      <xsl:text>  "concept": "</xsl:text>
      <xsl:value-of select="cda:code/@code"/>
      <xsl:text>",&#xA;</xsl:text>
      <xsl:text>  "obsDatetime": "</xsl:text>
      <xsl:value-of select="$dateFormat"/>
      <xsl:text>",&#xA;</xsl:text>
```

```
      <xsl:text>  "value": "</xsl:text>
      <xsl:for-each select="cda:text/cda:list/cda:item">
         <xsl:value-of select="."/>
         <xsl:text> </xsl:text>
      </xsl:for-each>
      <xsl:text>"&#xA;</xsl:text>
      <xsl:text>}</xsl:text>
   </xsl:template>

</xsl:stylesheet>
```

JSON Output


```
{
 "person": "2.16.840.1.113883.4.1",
 "concept": "8302-2",
 "obsDatetime": "2024-03-10T00:-0:80.000+0000",
 "value": "177"
},
{
 "person": "2.16.840.1.113883.4.1",
 "concept": "8480-6",
 "obsDatetime": "2024-03-10T00:-0:80.000+0000",
 "value": "132"
},
{
 "person": "2.16.840.1.113883.4.1",
 "concept": "8462-4",
 "obsDatetime": "2024-03-10T00:-0:80.000+0000",
 "value": "88"
},
{
 "person": "2.16.840.1.113883.4.1",
 "concept": "8302-2",
 "obsDatetime": "2024-03-10T00:-0:80.000+0000",
 "value": "177"
},
{
 "person": "2.16.840.1.113883.4.1",
 "concept": "8480-6",
 "obsDatetime": "2024-03-10T00:-0:80.000+0000",
 "value": "128"
},
```

{
"person": "2.16.840.1.113883.4.1",
"concept": "8462-4",
"obsDatetime": "2024-03-10T00:-0:80.000+0000",
"value": "80"
}
]
{
"person": "2.16.840.1.113883.4.1",
"concept": "29545-1",
"obsDatetime": "2024-03-10T00:-0:80.000+0000",
"value": "HEENT: All normal to examination. Heart: RRR, no murmur. THORAX and LUNGS: Clear without rhonchi or wheeze. ABDOMEN: No distension, tenderness, or guarding, obese, pos bowel sounds. BACK: Normal to inspection and palpation, without tenderness; no presacral edema. EXTREMITIES: No edema or swelling noted, no evidence of chronic stasis changes, and symmetrical appearance without any asymmetry.. "
}

Medications –

Create a drug (OpenMRS Format)

Create a drug

```
{
    "concept": "08e5f67d-b63e-4f99-a09b-e6193125cf77",
    "combination": true,
    "name": "drug name",
    "minimumDailyDose": 1,
    "maximumDailyDose": 5,
    "dosageForm": "08e5f67d-b63e-4f99-a09b-e6193125cf77"
}
```

XSLT JSON

```
<?xml version="1.0" encoding="UTF-8"?>
<xsl:stylesheet version="1.0" xmlns:xsl="http://www.w3.org/1999/XSL/Transform"
xmlns:cda="urn:hl7-org:v3">
  <xsl:output method="text"/>

  <xsl:template match="/">
    <xsl:variable name="medication"
select="//cda:component/cda:section[cda:templateId/@root='2.16.840.1.113883.10.20.22.2.1.1']"/>
    <xsl:variable name="drug1"
select="$medication/cda:entry/cda:substanceAdministration/cda:consumable[cda:manufactured
Product/cda:manufacturedMaterial/cda:code/@code='205304']"/>
  {
    "concept": <xsl:value-of
select="$medication/cda:entry/cda:substanceAdministration/cda:consumable/cda:manufactured
Product/cda:manufacturedMaterial/cda:code/@code"/>",
    "name": "<xsl:value-of
select="$drug1/cda:manufacturedProduct/cda:manufacturedMaterial/cda:code/@displayName"/
>",
    "minimumDailyDose": "<xsl:value-of
select="$medication/cda:entry/cda:substanceAdministration/cda:doseQuantity[1]/@value"/>",
    "maximumDailyDose": "<xsl:value-of
select="$medication/cda:entry/cda:substanceAdministration/cda:doseQuantity[1]/@value"/>",
    "dosageForm": "<xsl:value-of
select="$medication/cda:entry/cda:substanceAdministration/cda:administrationUnitCode/@disp
layName"/>"
  }
    <xsl:variable name="drug2"
```

```
select="$medication/cda:entry/cda:substanceAdministration/cda:consumable[cda:manufactured
Product/cda:manufacturedMaterial/cda:code/@code='197380']"/>
   {
      "concept": <xsl:value-of
select="$drug2/cda:manufacturedProduct/cda:manufacturedMaterial/cda:code/@code"/>",
      "name": "<xsl:value-of
select="$drug2/cda:manufacturedProduct/cda:manufacturedMaterial/cda:code/@displayName"/
>",
      "minimumDailyDose": "<xsl:value-of
select="$medication/cda:entry/cda:substanceAdministration/cda:doseQuantity[1]/@value"/>",
      "maximumDailyDose": "<xsl:value-of
select="$medication/cda:entry/cda:substanceAdministration/cda:doseQuantity[1]/@value"/>",
      "dosageForm": "<xsl:value-of
select="$medication/cda:entry/cda:substanceAdministration/cda:administrationUnitCode/@disp
layName"/>"
   }
  </xsl:template>
</xsl:stylesheet>
```

JSON Output

Results

```
1
2     {
3         "concept": 205304",
4         "name": "Telmisartan 40 MG Oral Tablet [Tenormin]",
5         "minimumDailyDose": "1",
6         "maximumDailyDose": "1",
7         "dosageForm": "Tablet"
8     }
9
10    {
11        "concept": 197380",
12        "name": "Atenolol 25 MG Oral Tablet",
13        "minimumDailyDose": "1",
14        "maximumDailyDose": "1",
15        "dosageForm": "Tablet"
16    }
17
18
```

Medication Order

Create an order type

Create an order type

```
POST /ordertype
{
    "name": "drug order3",
    "description": "One 500mg tablet of Ciprofloxacin, twice a day",
    "parent": "070f0120-0283-4858-885d-a20d967729cf",
    "javaClassName": "org.openmrs.DrugOrder"
}
```

XSLT JSON

```
<?xml version="1.0" encoding="UTF-8"?>
<xsl:stylesheet version="1.0" xmlns:xsl="http://www.w3.org/1999/XSL/Transform"
   xmlns:cda="urn:hl7-org:v3">
   <xsl:output method="text"/>

   <xsl:template match="/">
      <xsl:variable name="medication"
         select="//cda:component/cda:section[cda:templateId/@root =
'2.16.840.1.113883.10.20.22.2.1.1']"/>
      <xsl:variable name="drug1"

select="$medication/cda:entry/cda:substanceAdministration/cda:consumable[cda:manufactured
Product/cda:manufacturedMaterial/cda:code/@code = '205304']"/>
      {
       "description": "<xsl:value-of
select="$drug1/cda:manufacturedProduct/cda:manufacturedMaterial/cda:code/@displayName"/
>",
      "JavaClassName": "org.openmrs.DrugOrder"
      }
      <xsl:variable name="medication2" select="//cda:component/cda:section[cda:templateId/@root
```

```
= '2.16.840.1.113883.10.20.22.2.1.1']"/>
      <xsl:variable name="drug2"

select="$medication2/cda:entry/cda:substanceAdministration/cda:consumable[cda:manufacture
dProduct/cda:manufacturedMaterial/cda:code/@code = '197380']"/>
      {
      "description": "<xsl:value-of
select="$drug2/cda:manufacturedProduct/cda:manufacturedMaterial/cda:code/@displayName"/
>",
      "JavaClassName": "org.openmrs.DrugOrder"
      }

   </xsl:template>
```

Output (JSON)

Results

```
1
2         {
3          "description": "Telmisartan 40 MG Oral Tablet [Tenormin]",
4         "JavaClassName": "org.openmrs.DrugOrder"
5         }
6
7         {
8         "description": "Atenolol 25 MG Oral Tablet",
9         "JavaClassName": "org.openmrs.DrugOrder"
10        }
11
```

Appendix 2 System B

Patient Information - Create a Person

XSLT XML

```
<?xml version="1.0" encoding="UTF-8"?>
<xsl:stylesheet version="1.0" xmlns:xsl="http://www.w3.org/1999/XSL/Transform"
xmlns:n1="urn:hl7-org:v3">
   <xsl:output method="xml" indent="yes"/>

   <xsl:template match="/">
      <patient>
         <names>
            <givenName>
               <xsl:value-of
select="//n1:recordTarget/n1:patientRole/n1:patient/n1:name/n1:given"/>
            </givenName>
            <familyName>
               <xsl:value-of
select="//n1:recordTarget/n1:patientRole/n1:patient/n1:name/n1:family"/>
            </familyName>
         </names>
         <gender>
            <xsl:value-of
select="//n1:recordTarget/n1:patientRole/n1:patient/n1:administrativeGenderCode/@code"/>
         </gender>
         <birthdate>
            <xsl:value-of
select="//n1:recordTarget/n1:patientRole/n1:patient/n1:birthTime/@value"/>
         </birthdate>
         <addresses>
            <address>
               <address1>
                  <xsl:value-of
select="//n1:recordTarget/n1:patientRole/n1:addr/n1:streetAddressLine"/>
               </address1>
               <cityVillage>
                  <xsl:value-of select="//n1:recordTarget/n1:patientRole/n1:addr/n1:city"/>
               </cityVillage>
               <country>
                  <xsl:value-of select="//n1:recordTarget/n1:patientRole/n1:addr/n1:country"/>
               </country>
               <postalCode>
                  <xsl:value-of select="//n1:recordTarget/n1:patientRole/n1:addr/n1:postalCode"/>
```

```
            </postalCode>
         </address>
      </addresses>
   </patient>
</xsl:template>
</xsl:stylesheet>
```

XML output

Results

```
<?xml version="1.0" encoding="UTF-8"?>
<patient xmlns:n1="urn:hl7-org:v3">
   <names>
      <givenName>Josh</givenName>
      <familyName>Patel</familyName>
   </names>
   <gender>M</gender>
   <birthdate>19590501</birthdate>
   <addresses>
      <address>
         <address1>2024 Indiana Ave</address1>
         <cityVillage>Indidanapolis</cityVillage>
         <country>US</country>
         <postalCode>46202</postalCode>
      </address>
   </addresses>
</patient>
```

Medication Information - Create a Drug

XSLT XML

```
<?xml version="1.0" encoding="UTF-8"?>
<xsl:stylesheet version="1.0" xmlns:xsl="http://www.w3.org/1999/XSL/Transform"
xmlns:cda="urn:hl7-org:v3">
   <xsl:output method="xml" indent="yes"/>

   <xsl:template match="/">
      <output>
         <xsl:variable name="medication"
select="//cda:component/cda:section[cda:templateId/@root='2.16.840.1.113883.10.20.22.2.1.1']"/>
         <xsl:variable name="drug2"
select="$medication/cda:entry/cda:substanceAdministration/cda:consumable[cda:manufactured
Product/cda:manufacturedMaterial/cda:code/@code='197380']"/>
         <drug>
            <concept><xsl:value-of
select="$medication/cda:entry/cda:substanceAdministration/cda:consumable/cda:manufactured
Product/cda:manufacturedMaterial/cda:code/@code"/></concept>
            <name><xsl:value-of
select="$medication/cda:entry/cda:substanceAdministration/cda:consumable/cda:manufactured
Product/cda:manufacturedMaterial/cda:code/@displayName"/></name>
            <minimumDailyDose><xsl:value-of
select="$medication/cda:entry/cda:substanceAdministration/cda:doseQuantity[1]/@value"/></mi
nimumDailyDose>
            <maximumDailyDose><xsl:value-of
select="$medication/cda:entry/cda:substanceAdministration/cda:doseQuantity[1]/@value"/></m
aximumDailyDose>
            <dosageForm><xsl:value-of
select="$medication/cda:entry/cda:substanceAdministration/cda:administrationUnitCode/@disp
layName"/></dosageForm>
         </drug>
         <drug>
            <concept><xsl:value-of
select="$drug2/cda:manufacturedProduct/cda:manufacturedMaterial/cda:code/@code"/></conc
ept>
            <name><xsl:value-of
select="$drug2/cda:manufacturedProduct/cda:manufacturedMaterial/cda:code/@displayName"/
></name>
            <minimumDailyDose><xsl:value-of
select="$medication/cda:entry/cda:substanceAdministration/cda:doseQuantity[1]/@value"/></mi
nimumDailyDose>
            <maximumDailyDose><xsl:value-of
select="$medication/cda:entry/cda:substanceAdministration/cda:doseQuantity[1]/@value"/></m
aximumDailyDose>
```

```
            <dosageForm><xsl:value-of
select="$medication/cda:entry/cda:substanceAdministration/cda:administrationUnitCode/@displayName"/></dosageForm>
         </drug>
      </output>
   </xsl:template>
</xsl:stylesheet>
```

XML OUTPUT

Results

```
<?xml version="1.0" encoding="UTF-8"?>
<output xmlns:cda="urn:hl7-org:v3">
   <drug>
      <concept>205304</concept>
      <name>Telmisartan 40 MG Oral Tablet [Tenormin]</name>
      <minimumDailyDose>1</minimumDailyDose>
      <maximumDailyDose>1</maximumDailyDose>
      <dosageForm>Tablet</dosageForm>
   </drug>
   <drug>
      <concept>197380</concept>
      <name>Atenolol 25 MG Oral Tablet</name>
      <minimumDailyDose>1</minimumDailyDose>
      <maximumDailyDose>1</maximumDailyDose>
      <dosageForm>Tablet</dosageForm>
   </drug>
</output>

```

Medication Order

XSLT XML

```
<xsl:stylesheet version="1.0" xmlns:xsl="http://www.w3.org/1999/XSL/Transform"
   xmlns:cda="urn:hl7-org:v3">
   <xsl:output method="xml" indent="yes"/>

   <xsl:template match="/">
      <output>
         <drug>
            <description><xsl:value-of select="//cda:component/cda:section[cda:templateId/@root =
'2.16.840.1.113883.10.20.22.2.1.1']/cda:entry/cda:substanceAdministration/cda:consumable[cda:
manufacturedProduct/cda:manufacturedMaterial/cda:code/@code =
'205304']/cda:manufacturedProduct/cda:manufacturedMaterial/cda:code/@displayName"/></des
cription>
            <JavaClassName>org.openmrs.DrugOrder</JavaClassName>
         </drug>
         <drug>
            <description><xsl:value-of select="//cda:component/cda:section[cda:templateId/@root =
'2.16.840.1.113883.10.20.22.2.1.1']/cda:entry/cda:substanceAdministration/cda:consumable[cda:
manufacturedProduct/cda:manufacturedMaterial/cda:code/@code =
'197380']/cda:manufacturedProduct/cda:manufacturedMaterial/cda:code/@displayName"/></des
cription>
            <JavaClassName>org.openmrs.DrugOrder</JavaClassName>
         </drug>
      </output>
   </xsl:template>
</xsl:stylesheet>
```

XML OUTPUT

Results

```
<?xml version="1.0" encoding="UTF-8"?>
<output xmlns:cda="urn:hl7-org:v3">
   <drug>
      <description>Telmisartan 40 MG Oral Tablet [Tenormin]</description>
      <JavaClassName>org.openmrs.DrugOrder</JavaClassName>
   </drug>
   <drug>
      <description>Atenolol 25 MG Oral Tablet</description>
      <JavaClassName>org.openmrs.DrugOrder</JavaClassName>
   </drug>
</output>
```

References

Benson, T., & Grieve, G. (2016). *Principles of health interoperability* (Third ed.). Springer International. https://doi.org/10.1007/978-3-030-56883-2