

MINISTRY OF HEALTH

RHIE TECHNICAL DOCUMENTATION

RWANDA HEALTH INFORMATION EXCHANGE (RHIE)

Complete Implementation Documentation

Version: 2.0.0

FHIR Version: 4.0.0

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SYSTEM OVERVIEW

What is RHIE?

The Rwanda Health Information Exchange (RHIE) is a national health information system that enables the secure exchange of patient health information across healthcare facilities in Rwanda. It is built on FHIR (Fast Healthcare Interoperability Resources) standards.

Key Components

1. SHR (Shared Health Record) - Central repository for patient health records
2. Client Registry (CR) - Patient demographic and identifier management
3. UPID Generator - Unique Patient Identifier generation service

Swagger Documentation

Swagger documentation link

Supported Features

-  Patient Registration & Demographics

-  Visit & Consultation Management
 -  Vital Signs Recording
 -  Electronic Prescriptions (e-Prescription)
 -  Lab Orders & Results
 -  Imaging Orders & Studies
 -  Diagnosis & Conditions
 -  Procedures & Immunizations
 -  Electronic Transfers (e-Transfers)
 -  Medication Dispensing & Administration
 -  International Patient Summary (IPS)
 -  Patient Consent Management
-

ARCHITECTURE

Data Flow

1. Registration Flow: EMR → UPID Generator → Client Registry → SHR
 2. Clinical Data Flow: EMR → SHR (with references to CR)
 3. Query Flow: EMR → SHR → Response with linked resources
-

AUTHENTICATION & SECURITY

HTTP Basic Authentication

All API requests require HTTP Basic Authentication.

```
Authorization: Basic <base64(username:password)>
```

Example Credentials:

- Username: `MRS_TEST`
- Password: `Ubuzima1.`

Security Headers

```
Content-Type: application/fhir+json
Accept: application/fhir+json
Authorization: Basic TVJTX1RFU1Q6VWJ1emltYTEu
```

Request Example

```
curl -X GET \
  'http://197.243.24.138:5000/cr/Patient/251119-0001-4106' \
  -H 'Authorization: Basic TVJTX1RFU1Q6VWJ1emltYTEu' \
  -H 'Accept: application/fhir+json'
```

GLOBAL VALIDATIONS

All FHIR resources must comply with the following global validations:

Mandatory Requirements

1. Unique Identifiers: All resources must have a unique UUID identifier
2. Reference Resolution: All references (subject, encounter, practitioner, location) must resolve correctly
3. ISO 8601 Dates: All dates/times must be in ISO 8601 format
4. Logical Consistency: Dates must be logically consistent (no future dates for historical events)

5. Valid Terminologies: Coding must be from valid terminology systems
6. Deceased Validation: If patient has deceased status, no medical encounters should be saved after deceased date

Reference Format

All FHIR references must follow the pattern:

ResourceType/ResourceId

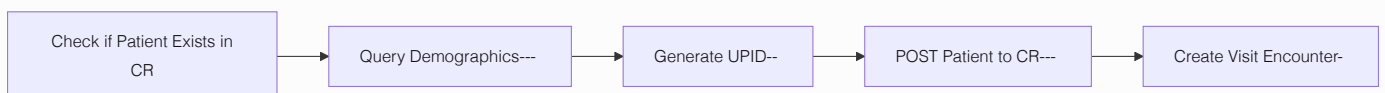
Examples:

- Patient/251119-0001-4106
 - Encounter/9a8e5398-64ee-4111-84a0-9e1e6e0a0121
 - Practitioner/HLC-PRAC-2025-00005
 - Location/1163f2b9-08b0-4333-8e60-6a6fadc91f4f
-

PATIENT JOURNEY

The complete patient journey through the RHIE system follows these steps:

1. Patient Registration



Key Points:

- UPID Format:

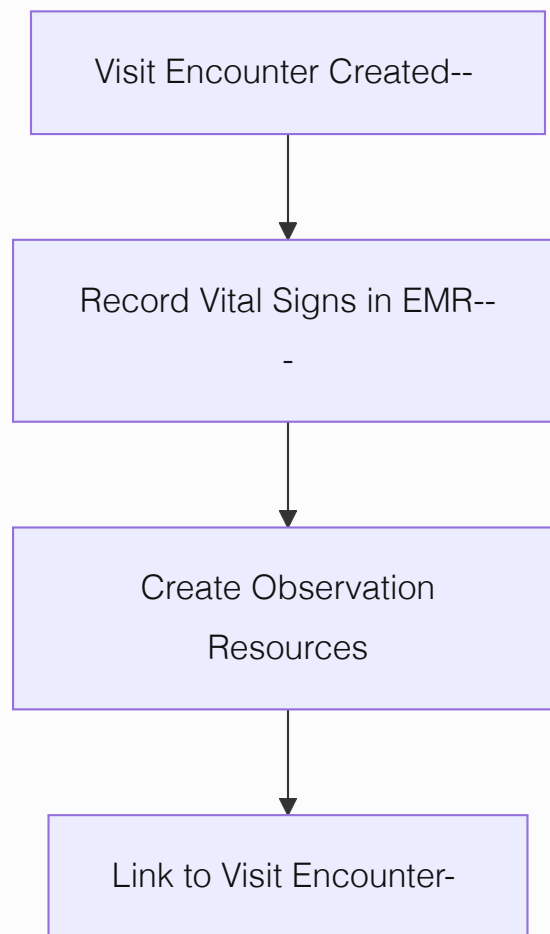
YYMMDD-FOSAID-RAND4

 (e.g.,

251119-0001-4106

)
- NID validation against DOB is performed by CR service
- Patient must exist before any clinical data

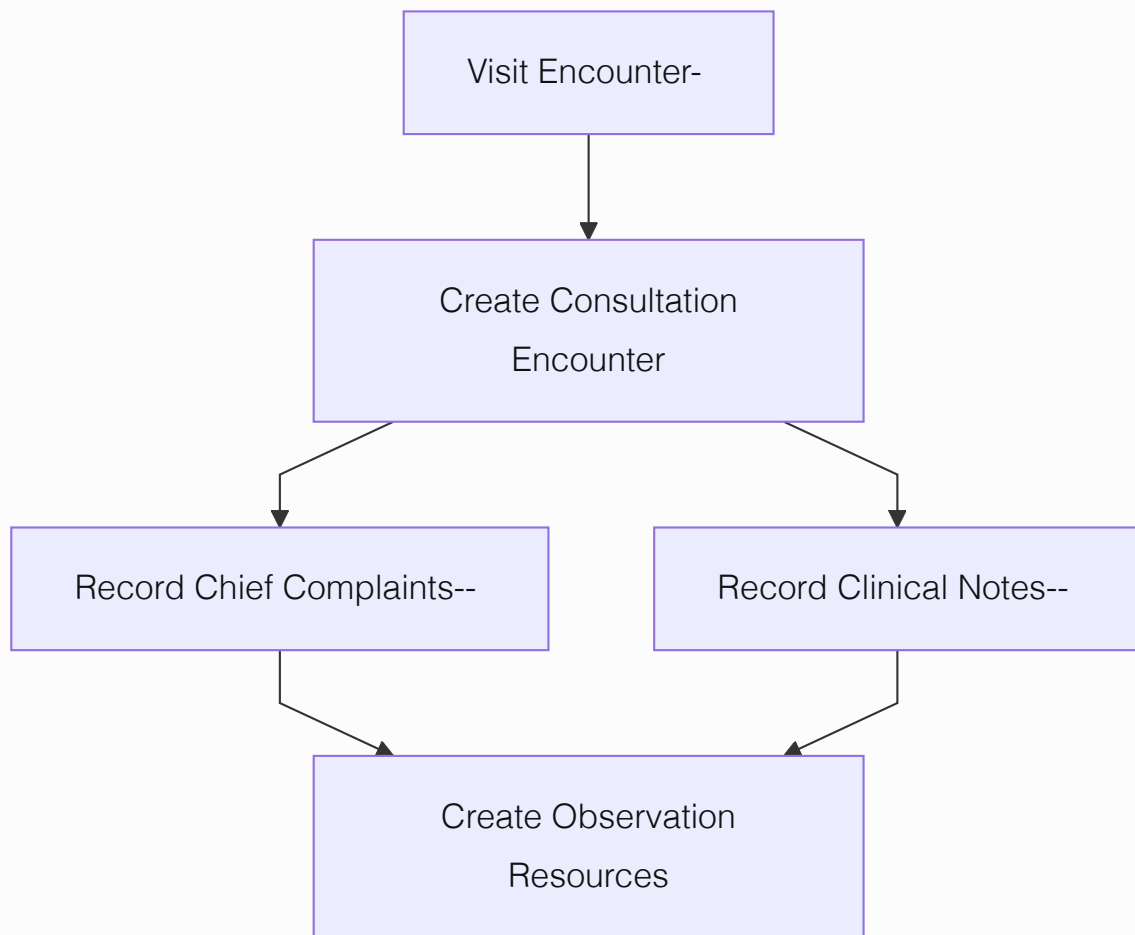
2. Vital Signs Recording



Vital Signs May Include:

- Blood Pressure (Systolic/Diastolic)
- Heart Rate
- Respiratory Rate
- Temperature
- Oxygen Saturation
- Weight/Height/BMI

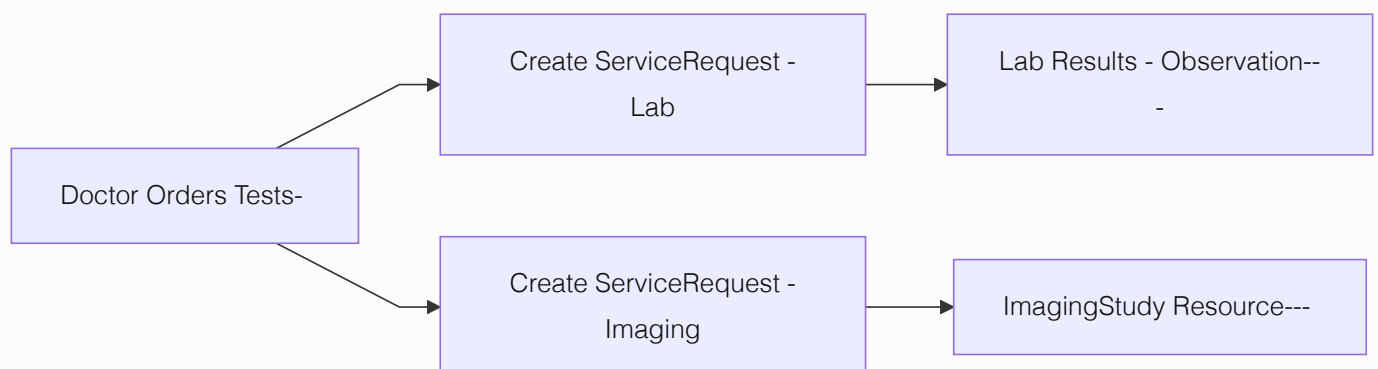
3. Consultation Encounter



Consultation Structure:

- Consultation Encounter (Must always reference Visit Encounter)
- Chief Complaints (Observation referecing Consultation encounter)
- Clinical Findings (Observation referecing Consultation encounter)
- Assessment Notes (Observation referecing Consultation encounter)

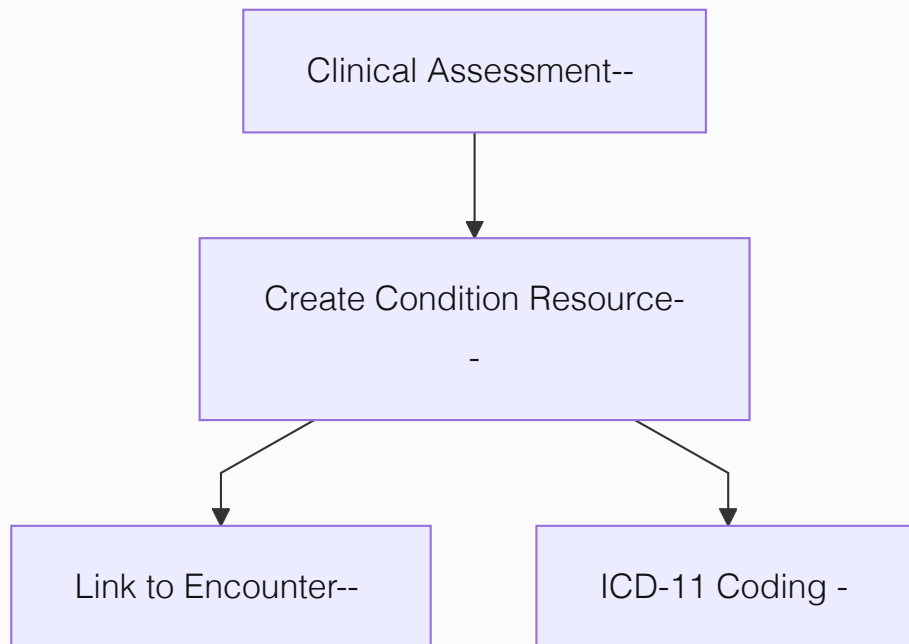
4. Investigations



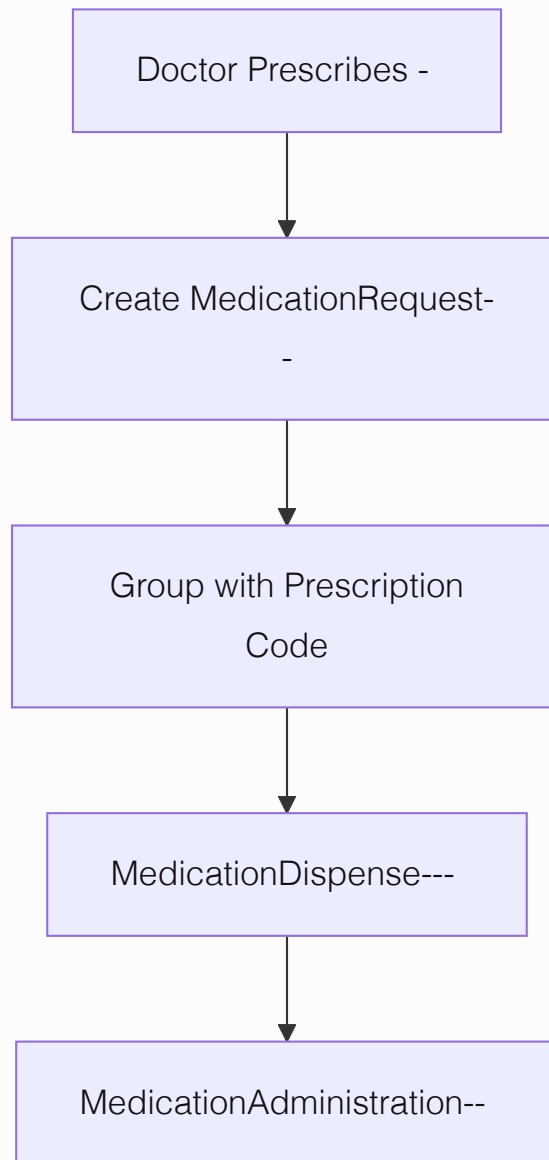
Investigation Types:

- Laboratory Tests (ServiceRequest → Observation)
- Imaging Studies (ServiceRequest → ImagingStudy)
- Diagnostic Reports (DiagnosticReport)

5. Diagnosis



6. Treatment



Treatment Flow:

- MedicationRequest: Prescription order (e-Prescription)
- MedicationDispense: Pharmacy dispensing
- MedicationAdministration: Actual administration to patient

Key Concept - groupIdentifier:

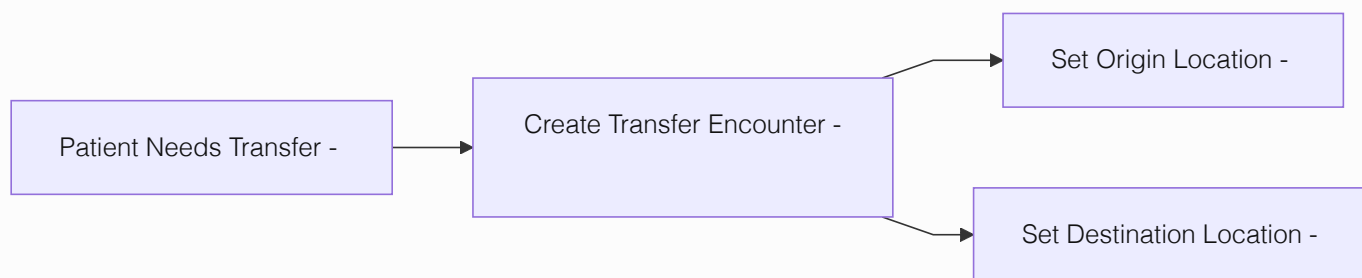
Multiple medications prescribed together share the same `groupIdentifier` (prescription code).

7. Procedures & Immunizations

- Procedure: Record surgical or medical procedures performed

- Immunization: Record vaccines administered

8. Transfers



FHIR RESOURCES

Resource Hierarchy

```

Patient (Root)
├── Consent
├── Encounter (Visit)
│   ├── Encounter (Consultation)
│   │   ├── Observation (Chief Complaints)
│   │   └── Observation (Clinical Findings)
│   ├── Encounter (Transfer)
│   ├── Observation (Vital Signs)
│   ├── Condition (Diagnosis)
│   ├── AllergyIntolerance
│   ├── Immunization
│   ├── ServiceRequest (Lab Order)
│   │   └── Observation (Lab Results)
│   ├── ServiceRequest (Imaging Order)
│   │   └── ImagingStudy
│   ├── Procedure
│   └── MedicationRequest (Prescription)
│       ├── MedicationDispense
│       └── MedicationAdministration
└── Bundle (IPS - International Patient Summary)
  
```

Core Resources Overview

Resource	Purpose	Key Identifiers
Patient	Patient demographics	UPID, NID, Passport
Consent	Patient consent records	Patient reference
Encounter	Healthcare visit/interaction	Visit ID, Type
Observation	Clinical observations	Category, Code
Condition	Diagnoses	ICD-11 Code
AllergyIntolerance	Allergies	NPC Code
Immunization	Vaccinations	NPC Code
ServiceRequest	Orders for services	Category, Code
ImagingStudy	Imaging results	DICOM modality
Procedure	Procedures performed	ICHI Code
MedicationRequest	Prescriptions	SNOMED CT Code
MedicationDispense	Medication dispensing	SNOMED CT Code
MedicationAdministration	Medication given	SNOMED CT Code

API ENDPOINTS

Patient Management

1. Search Patient

```

GET /Patient?identifier={upid}
GET /Patient?given={firstName}&family={lastName}
GET /Patient?birthdate={YYYY-MM-DD}

```

Response:

```
{
```

```
"resourceType": "Bundle",
"type": "searchset",
"total": 1,
"entry": [
  {
    "resource": {
      "resourceType": "Patient",
      "id": "251119-0001-4106",
      "identifier": [
        {
          "system": "UPI",
          "value": "251119-0001-4106"
        }
      ]
    }
  }
]
```

2. Create Patient

POST /Patient
Content-Type: application/fhir+json

Request Body:

```
{
  "resourceType": "Patient",
  "id": "251119-0001-4106",
  "identifier": [
    {
      "system": "NID",
      "value": "1192880005226000"
    },
    {
      "system": "UPI",
      "value": "251119-0001-4106"
    }
  ],
  "active": true,
  "name": [
```

```

    {
      "family": "MUGISHA",
      "given": ["BENON"]
    }
  ],
  "gender": "male",
  "birthDate": "1928-01-01",
  "telecom": [
    {
      "system": "phone",
      "value": "+250796000075",
      "use": "mobile"
    }
  ],
  "address": [
    {
      "type": "physical",
      "country": "Rwanda",
      "state": "1#Umujiyi wa Kigali (Kigali City)",
      "district": "1#Nyarugenge",
      "line": "1#Gihanga",
      "city": "1#Umujiyi wa Kigali (Kigali City)"
    }
  ],
  "maritalStatus": {
    "coding": [
      {
        "system": "http://terminology.hl7.org/CodeSystem/v3-MaritalStatus",
        "code": "S",
        "display": "SINGLE"
      }
    ]
  },
  "deceasedBoolean": false
}

```

3. Read Patient

```
GET /Patient/{id}
```

Consent Management

Create Consent

POST /Consent

Request Body:

```
{
  "resourceType": "Consent",
  "status": "active",
  "scope": {
    "coding": [
      {
        "system":
"http://terminology.hl7.org/CodeSystem/consentscope",
        "code": "patient-privacy",
        "display": "Privacy Consent"
      }
    ]
  },
  "category": [
    {
      "coding": [
        {
          "system": "http://terminology.hl7.org/CodeSystem/v3-ActCode",
          "code": "INFA",
          "display": "information access"
        }
      ]
    }
  ],
  "patient": {
    "reference": "Patient/251119-0001-4106"
  },
  "dateTime": "2025-11-18T10:18:07+00:00"
}
```

Encounter Management

1. Create Visit Encounter

POST /Encounter

Request Body:

```
{
  "resourceType": "Encounter",
  "id": "9a8e5398-64ee-4111-84a0-9e1e6e0a0121",
  "meta": {
    "tag": [
      {
        "system": "http://fhir.openmrs.org/ext/encounter-tag",
        "code": "encounter",
        "display": "Encounter"
      }
    ]
  },
  "status": "finished",
  "class": {
    "system": "http://terminology.hl7.org/CodeSystem/v3-ActCode",
    "code": "AMB",
    "display": "Ambulatory"
  },
  "type": [
    {
      "coding": [
        {
          "display": "VISIT_ENCOUNTER"
        }
      ]
    }
  ],
  "serviceType": {
    "coding": [
      {
        "system":
"http://terminology.hl7.org/CodeSystem/service-type",
        "display": "Outpatients"
      }
    ]
  }
}
```

```

    ]
  },
  "subject": {
    "reference": "Patient/251119-0001-4106",
    "type": "Patient",
    "display": "BENON MUGISHA"
  },
  "participant": [
    {
      "individual": {
        "reference": "Practitioner/HLC-PRAC-2025-00005",
        "display": "MUTIMUKEYE Clarisse"
      }
    }
  ],
  "period": {
    "start": "2025-11-19T13:35:35+02:00"
  },
  "location": [
    {
      "location": {
        "reference": "Location/1163f2b9-08b0-4333-8e60-6a6fadc91f4f",
        "display": "Kibagabaga Level Two Teaching Hospital"
      }
    }
  ]
}

```

2. Create Consultation Encounter

POST /Encounter

Request Body:

```

{
  "resourceType": "Encounter",
  "id": "0c9036b7-5b25-4465-8c77-a4bb1cbda95",
  "status": "finished",
  "class": {

```



```

    "system": "http://terminology.hl7.org/CodeSystem/v3-
ActCode",
    "code": "AMB"
  },
  "type": [
    {
      "coding": [
        {
          "display": "CONSULTATION_ENCOUNTER"
        }
      ]
    }
  ],
  "subject": {
    "reference": "Patient/251119-0001-4106"
  },
  "participant": [
    {
      "individual": {
        "reference": "Practitioner/HLC-PRAC-2025-00005"
      }
    }
  ],
  "period": {
    "start": "2025-11-19T13:35:35+02:00"
  },
  "location": [
    {
      "location": {
        "reference": "Location/1163f2b9-08b0-4333-8e60-
6a6fadc91f4f"
      }
    }
  ],
  "partOf": {
    "reference": "Encounter/9a8e5398-64ee-4111-84a0-
9e1e6e0a0121"
  }
}

```

3. Create Transfer Encounter

POST /Encounter

Request Body:

```
{
  "resourceType": "Encounter",
  "id": "6370fc4a-4f77-4a53-93e4-6cced7325474",
  "status": "finished",
  "class": {
    "system": "http://terminology.hl7.org/CodeSystem/v3-ActCode",
    "code": "AMB"
  },
  "type": [
    {
      "coding": [
        {
          "display": "TRANSFER_ENCOUNTER"
        }
      ]
    }
  ],
  "subject": {
    "reference": "Patient/251119-0001-4106"
  },
  "participant": [
    {
      "individual": {
        "reference": "Practitioner/HLC-PRAC-2025-00005"
      }
    }
  ],
  "period": {
    "start": "2025-11-19T13:35:35+02:00"
  },
  "hospitalization": {
    "origin": {
      "reference": "Location/1163f2b9-08b0-4333-8e60-6a6fadc91f4f",
      "identifier": {
        "value": "0001"
      }
    }
  },
}
```

```

        "display": "Kicukiro Health Center"
      },
      "destination": {
        "reference": "Location/1163f2b9-08b0-4333-8e60-6a6fadc91f4f",
        "identifier": {
          "value": "0002"
        },
        "display": "Kibagabaga Hospital"
      }
    },
    "location": [
      {
        "location": {
          "reference": "Location/1163f2b9-08b0-4333-8e60-6a6fadc91f4f"
        }
      }
    ],
    "partOf": {
      "reference": "Encounter/9a8e5398-64ee-4111-84a0-9e1e6e0a0121"
    }
  }
}

```

4. Search Encounters

```

GET /Encounter?fromDate={yyyy-mm-dd}&toDate={yyyy-mm-dd}&page=1&size=20
GET /Encounter?searchSet=UPI&value={upid}

```

Observation Management

1. Create Vital Signs Observation

```
POST /Observation
```

Request Body:

```
{
```

```
"resourceType": "Observation",
"id": "9a89ba8a-ca93-4449-9d89-71aeb6b4352a",
"status": "final",
"category": [
  {
    "coding": [
      {
        "system":
"http://terminology.hl7.org/CodeSystem/observation-category",
        "code": "vital-signs",
        "display": "Vital Signs"
      }
    ]
  }
],
"code": {
  "coding": [
    {
      "system": "http://loinc.org",
      "code": "8480-6",
      "display": "Systolic blood pressure"
    }
  ]
},
"subject": {
  "reference": "Patient/251119-0001-4106"
},
"encounter": {
  "reference": "Encounter/9a8e5398-64ee-4111-84a0-
9e1e6e0a0121"
},
"performer": [
  {
    "reference": "Practitioner/f830114a-bc0b-410e-b8c7-
79e61c0df653",
    "display": "Salman Muhammed"
  }
],
"valueQuantity": {
  "value": 160,
  "unit": "mmHg",
  "system": "http://unitsofmeasure.org"
},
```

```
"effectiveDateTime": "2025-11-18T06:18:07+00:00"
}
```

2. Create Consultation Observation (Chief Complaints)

POST /Observation

Request Body:

```
{
  "resourceType": "Observation",
  "id": "404c4536-3773-4f62-83c4-a1b23ab9dfb2",
  "status": "final",
  "category": [
    {
      "coding": [
        {
          "system":
"http://terminology.hl7.org/CodeSystem/observation-category",
          "code": "survey",
          "display": "Survey"
        }
      ]
    }
  ],
  "code": {
    "coding": [
      {
        "system": "http://loinc.org",
        "code": "33747-0",
        "display": "Chief Complaints"
      }
    ]
  },
  "subject": {
    "reference": "Patient/251119-0001-4106"
  },
  "encounter": {
    "reference": "Encounter/9a8e5398-64ee-4111-84a0-
9e1e6e0a0121"
  },
}
```

```
"performer": [  
  {  
    "reference": "Practitioner/f830114a-bc0b-410e-b8c7-  
79e61c0df653"  
  }  
,  
  "valueString": "Headache since 2 days",  
  "effectiveDateTime": "2025-11-18T06:18:07+00:00"  
}
```

3. Create Lab Results Observation

POST /Observation

Request Body:

```
{  
  "resourceType": "Observation",  
  "id": "304c4536-3773-4f62-83c4-a1b23ab9dfb1",  
  "status": "final",  
  "category": [  
    {  
      "coding": [  
        {  
          "system":  
"http://terminology.hl7.org/CodeSystem/observation-category",  
          "code": "laboratory",  
          "display": "Laboratory"  
        }  
      ]  
    }  
  ],  
  "code": {  
    "coding": [  
      {  
        "system": "http://loinc.org",  
        "code": "33747-0",  
        "display": "Full Blood Count"  
      }  
    ]  
  },  
}
```

```
"subject": {
  "reference": "Patient/251119-0001-4106"
},
"encounter": {
  "reference": "Encounter/9a8e5398-64ee-4111-84a0-9e1e6e0a0121"
},
"performer": [
  {
    "reference": "Practitioner/f830114a-bc0b-410e-b8c7-79e61c0df653"
  }
],
"valueQuantity": {
  "value": 160,
  "unit": "mmHg",
  "system": "http://unitsofmeasure.org"
},
"effectiveDateTime": "2025-11-18T06:18:07+00:00"
}
```

AllergyIntolerance Management

Create AllergyIntolerance

POST /AllergyIntolerance

Request Body:

```
{
  "resourceType": "AllergyIntolerance",
  "id": "9c3cd6b6-1e07-4dd8-94ad-2edb41d0f1bc",
  "clinicalStatus": {
    "coding": [
      {
        "system":
"http://terminology.hl7.org/CodeSystem/allergyintolerance-clinical",
        "code": "active"
      }
    ]
  }
}
```

```

},
"verificationStatus": {
  "coding": [
    {
      "system":
"http://terminology.hl7.org/CodeSystem/allergyintolerance-
verification",
      "code": "confirmed"
    }
  ]
},
"patient": {
  "reference": "Patient/251119-0001-4106"
},
"encounter": {
  "reference": "Encounter/9a8e5398-64ee-4111-84a0-
9ele6e0a0121"
},
"code": {
  "coding": [
    {
      "system": "http://npc.rw/npc",
      "code": "227493005",
      "display": "Penicillin"
    }
  ]
},
"onsetDateTime": "2025-11-18T10:18:07+00:00",
"recordedDate": "2025-11-18",
"extension": [
  {
    "url":
"http://example.org/fhir/StructureDefinition/location",
    "valueReference": {
      "reference": "Location/12345"
    }
  }
]
}

```

Immunization Management

Create Immunization

POST /Immunization

Request Body:

```
{
  "resourceType": "Immunization",
  "id": "3d178818-a99c-442d-9694-c88525e0ee26",
  "status": "completed",
  "vaccineCode": {
    "coding": [
      {
        "system": "http://npc.rw",
        "code": "333598008",
        "display": "Influenza vaccine"
      }
    ]
  },
  "patient": {
    "reference": "Patient/251119-0001-4106"
  },
  "encounter": {
    "reference": "Encounter/9a8e5398-64ee-4111-84a0-9e1e6e0a0121"
  },
  "occurrenceDateTime": "2024-11-18T10:18:10+00:00",
  "location": {
    "reference": "Location/e7fafc08-6a99-4dae-bf13-a9a7d8b0df8d",
    "display": "Kibagabaga Hospital"
  },
  "performer": [
    {
      "function": {
        "coding": [
          {
            "system": "http://terminology.hl7.org/CodeSystem/v2-0443",
            "code": "AP",
            "display": "Administering Provider"
          }
        ]
      }
    }
  ]
}
```

```

        }
      ]
    },
    "actor": {
      "reference": "Practitioner/cd65ae81-e6d5-4e3c-a8e9-dd9b3d5b28af",
      "display": "Dr Aziz Muhammed"
    }
  }
]
}

```

ServiceRequest Management (Lab Orders)

Create Lab Order

POST /ServiceRequest

Request Body:

```

{
  "resourceType": "ServiceRequest",
  "id": "a430a35a-978b-4a0c-a564-efc6d639bcd3",
  "status": "active",
  "intent": "order",
  "category": {
    "coding": {
      "system": "http://snomed.info/sct",
      "code": "108252007",
      "display": "Laboratory procedure"
    }
  },
  "code": {
    "coding": [
      {
        "system": "http://snomed.info/sct",
        "code": "15220000",
        "display": "Full Blood Count"
      }
    ]
  }
},

```

```
"subject": {
  "reference": "Patient/251119-0001-4106"
},
"encounter": {
  "reference": "Encounter/9a8e5398-64ee-4111-84a0-9e1e6e0a0121"
},
"occurrenceDateTime": "2025-11-18T09:18:09+00:00",
"requester": {
  "reference": "Practitioner/cd65ae81-e6d5-4e3c-a8e9-dd9b3d5b28af",
  "display": "Dr Aziz Muhammed"
},
"performer": {
  "reference": "Practitioner/cd65ae81-e6d5-4e3c-a8e9-dd9b3d5b28af"
},
"locationReference": {
  "reference": "Location/12345"
}
}
```

ImagingStudy Management

Create ImagingStudy

POST /ImagingStudy

Request Body:

```
{
  "resourceType": "ImagingStudy",
  "id": "f6991e61-26cd-4f97-b652-25738e7c8b89",
  "status": "available",
  "modality": {
    "system": "https://dicom.nema.org/",
    "code": "XA",
    "display": "X-Ray Angiography"
  },
  "subject": {
    "reference": "Patient/251119-0001-4106"
  }
}
```

```
,
"encounter": {
  "reference": "Encounter/9a8e5398-64ee-4111-84a0-
9e1e6e0a0121"
},
"started": "2025-11-19T14:30:00+02:00",
"procedureCode": [
  {
    "coding": [
      {
        "system": "http://www.ichi.org/",
        "code": "71250",
        "display": "X-ray of right shoulder"
      }
    ]
  }
],
"reasonCode": [
  {
    "coding": [
      {
        "system": "http://hl7.org/fhir/sid/icd-10",
        "code": "R05.1",
        "display": "Acute Pain"
      }
    ]
  }
],
"description": "X-ray of right shoulder",
"conclusion": "No evidence of fracture. Mild degenerative
changes noted.",
"conclusionCode": [
  {
    "coding": [
      {
        "system": "http://snomed.info/sct",
        "code": "42989003",
        "display": "Ground-glass opacity"
      }
    ]
  }
],
"series": [
```

```

{
  "uid": "1.2.3.4.5.6.7.8.1",
  "number": 1,
  "description": "X-ray of right shoulder",
  "bodySite": {
    "code": {
      "coding": [
        {
          "system": "http://snomed.info/sct",
          "code": "39607008",
          "display": "Right Shoulder"
        }
      ]
    }
  },
  "instance": [
    {
      "uid": "1.2.3.4.5.6.7.8.1.1",
      "sopClass": {
        "system": "urn:ietf:rft:3986",
        "code": "1.2.840.10008.5.1.4.1.1.2"
      },
      "number": 1,
      "title": "XRAY Image Instance"
    }
  ]
}

```

Condition Management (Diagnosis)

Create Condition

POST /Condition

Request Body:

```

{
  "resourceType": "Condition",
  "id": "a3fbd599-5ae9-4043-a9ba-27795822a393",

```

```
"clinicalStatus": {
  "coding": [
    {
      "system":
"http://terminology.hl7.org/CodeSystem/condition-clinical",
      "code": "active"
    }
  ]
},
"verificationStatus": {
  "coding": [
    {
      "system":
"http://terminology.hl7.org/CodeSystem/condition-ver-status",
      "code": "confirmed"
    }
  ]
},
"code": {
  "coding": [
    {
      "system": "https://icd.who.int",
      "code": "1F42",
      "display": "Malaria due to Plasmodium malariae"
    }
  ]
},
"subject": {
  "reference": "Patient/251119-0001-4106"
},
"encounter": {
  "reference": "Encounter/9a8e5398-64ee-4111-84a0-
9e1e6e0a0121"
},
"onsetDateTime": "2025-11-18T10:18:07+00:00",
"asserter": {
  "reference": "Practitioner/f830114a-bc0b-410e-b8c7-
79e61c0df653",
  "display": "Dr. Aziz Muhammed"
}
}
```

Procedure Management

Create Procedure

POST /Procedure

Request Body:

```
{
  "resourceType": "Procedure",
  "id": "288b63e3-3ad1-4ee2-b431-4fd394655fa6",
  "status": "completed",
  "code": {
    "coding": [
      {
        "system": "ICHI",
        "code": "18629005",
        "display": "Administration of vaccine"
      }
    ]
  },
  "subject": {
    "reference": "Patient/251119-0001-4106"
  },
  "encounter": {
    "reference": "Encounter/9a8e5398-64ee-4111-84a0-9e1e6e0a0121"
  },
  "performedDateTime": "2025-11-19T19:17:57+00:00",
  "performer": [
    {
      "function": {
        "coding": [
          {
            "system": "http://terminology.hl7.org/CodeSystem/v3-ParticipationType",
            "code": "PRF",
            "display": "Performer"
          }
        ]
      }
    }
  ],
}
```

```
    "actor": {
      "reference": "Practitioner/818565f8-b6f2-41ad-9218-
b7075738985b",
      "display": "Dr. Aziz Muhammed"
    }
  ],
  "location": {
    "reference": "Location/745c17bb-a41b-494c-9955-
48491f7de5bb",
    "display": "Kibagabaga Hospital"
  }
}
```

Medication Management

1. Create MedicationRequest (e-Prescription)

POST /MedicationRequest

Request Body:

```
{
  "resourceType": "MedicationRequest",
  "id": "6d7c9160-c48f-4dc4-ab9f-d518c7d0e695",
  "status": "active",
  "intent": "order",
  "medicationCodeableConcept": {
    "coding": [
      {
        "system": "http://snomed.info/sct",
        "code": "372756006",
        "display": "Amoxicillin"
      }
    ]
  },
  "subject": {
    "reference": "Patient/251119-0001-4106"
  },
  "encounter": {
```



```
    "reference": "Encounter/9a8e5398-64ee-4111-84a0-9e1e6e0a0121"
  },
  "authoredOn": "2025-11-18T09:30:00+02:00",
  "requester": {
    "reference": "Practitioner/dr-mutesi-jane",
    "display": "Dr. Jane Mutesi"
  },
  "groupIdentifier": {
    "system": "http://moh.gov.rw/prescription-code",
    "value": "PR-2025-11-20-001"
  },
  "insurance": [
    {
      "reference": "Coverage/cov-mituelle-230321",
      "display": "Mituelle de Santé"
    }
  ],
  "dosageInstruction": [
    {
      "text": "Take 2 tablets by mouth three times daily for 7 days",
      "timing": {
        "repeat": {
          "frequency": 3,
          "period": 1,
          "periodUnit": "d"
        }
      },
      "route": {
        "coding": [
          {
            "system": "http://snomed.info/sct",
            "code": "26643006",
            "display": "Oral route"
          }
        ]
      },
      "doseAndRate": [
        {
          "doseQuantity": {
            "value": 50,
            "unit": "mg",
```

```

        "system":
"http://terminology.hl7.org/CodeSystem/v3-orderableDrugForm",
        "code": "Mg"
    }
}
],
"extension": [
{
    "url":
"http://hl7.org/fhir/StructureDefinition/location",
    "valueReference": {
        "reference": "Location/87654321-abcd-efgh-ijkl-
1234567890ab",
        "display": "KIBAGABAGA District Hospital"
    }
}
]
}

```

Note on groupIdIdentifier: When multiple medications are prescribed together (a prescription), they all share the same `groupIdIdentifier` value (prescription code).

2. Create MedicationDispense

POST `/MedicationDispense`

Request Body:

```

{
  "resourceType": "MedicationDispense",
  "id": "d64229f8-af5b-4818-9e0d-8072d2b0c05a",
  "status": "completed",
  "medicationCodeableConcept": {
    "coding": [
      {
        "system": "http://snomed.info/sct",
        "code": "387517004",
        "display": "Paracetamol"
      }
    ]
  }
}

```

```
]
},
"subject": {
  "reference": "Patient/251119-0001-4106"
},
"encounter": {
  "reference": "Encounter/9a8e5398-64ee-4111-84a0-
9e1e6e0a0121"
},
"authorizingPrescription": [
  {
    "reference": "MedicationRequest/6d7c9160-c48f-4dc4-ab9f-
d518c7d0e695"
  }
],
"performer": [
  {
    "actor": {
      "reference": "Practitioner/ba98f017-80b0-4af3-8819-
b3bdef862aca",
      "display": "Dr. Johnson Bill"
    }
  }
],
"destination": {
  "reference": "Location/87654321-abcd-efgh-ijkl-
1234567890ab",
  "display": "KIBAGABAGA Hospital"
},
"whenHandedOver": "2025-11-18T02:00:00+00:00",
"quantity": {
  "value": 500,
  "unit": "mg",
  "system": "http://unitsofmeasure.org"
},
"dosageInstruction": [
  {
    "timing": {
      "repeat": {
        "frequency": 2,
        "period": 1,
        "periodUnit": "d"
      }
    }
  }
]
```

```

    },
    "route": {
      "coding": [
        {
          "system": "http://snomed.info/sct",
          "code": "26643006",
          "display": "Oral route"
        }
      ]
    },
  },
  "doseAndRate": [
    {
      "doseQuantity": {
        "value": 500,
        "unit": "mg",
        "system": "http://unitsofmeasure.org"
      }
    }
  ]
}

```

3. Create MedicationAdministration

POST /MedicationAdministration

Request Body:

```

{
  "resourceType": "MedicationAdministration",
  "id": "9d99df65-d61d-4c7a-b3e5-9b9d18ba88d5",
  "status": "completed",
  "medicationCodeableConcept": {
    "coding": [
      {
        "system": "http://snomed.info/sct",
        "code": "372756006",
        "display": "Amoxicillin"
      }
    ]
  }
}

```

```
,
"subject": {
  "reference": "Patient/251119-0001-4106"
},
"context": {
  "reference": "Encounter/9a8e5398-64ee-4111-84a0-9e1e6e0a0121"
},
"supportingInformation": [
  {
    "reference": "MedicationRequest/6d7c9160-c48f-4dc4-ab9f-d518c7d0e695"
  }
],
"effectiveDateTime": "2025-11-18T10:15:00+02:00",
"performer": [
  {
    "function": {
      "coding": [
        {
          "system":
"http://terminology.hl7.org/CodeSystem/medication-admin-performer-function",
          "code": "performer",
          "display": "Performer"
        }
      ]
    },
    "actor": {
      "reference": "Practitioner/nurse-12345",
      "display": "Nurse Uwase Marie"
    }
  }
],
"request": {
  "reference": "MedicationRequest/6d7c9160-c48f-4dc4-ab9f-d518c7d0e695"
},
"dosage": {
  "text": "Injection IV",
  "route": {
    "coding": [
      {
```

```

        "system": "http://snomed.info/sct",
        "code": "26643006",
        "display": "Intravenous route"
      }
    ],
  },
  "method": {
    "coding": [
      {
        "system": "http://snomed.info/sct",
        "code": "738995006",
        "display": "Injection"
      }
    ]
  },
  "dose": {
    "value": 100,
    "unit": "mg",
    "system": "http://unitsofmeasure.org",
    "code": "mg"
  }
},
"extension": [
  {
    "url":
"http://hl7.org/fhir/StructureDefinition/medicationadministration-location",
    "valueReference": {
      "reference": "Location/87654321-abcd-efgh-ijkl-1234567890ab",
      "display": "KIBAGABAGA District Hospital"
    }
  }
]
}

```

International Patient Summary (IPS)

Get IPS

```
GET /Bundle/$ips?patient={patientId}
```

Response: Returns a complete Bundle containing all patient clinical information in IPS format.

VALIDATION RULES

Patient Validations

Rule	Description	Error Message
UPID Format	Must match: <div>YYMMDD-FOSAID-RAND4</div>	"Invalid UPID format"
NID vs DOB	If NID provided, must validate against DOB	"NID does not match birth date"
Future DOB	Birth date cannot be in the future	"Birth date cannot be future dated"
Resource ID = UPID	Resource identifier must equal UPID identifier	"Resource ID must match UPID"
Required Fields	identifier, name, gender, birthDate required	"Missing required field: {field}"
Deceased Check	No encounters after deceased date	"Cannot create encounter for deceased patient"

Encounter Validations

Rule	Description	Error Message
Subject Required	Patient reference mandatory	"Subject is required"
Practitioner Required	Participant with practitioner reference mandatory	"Practitioner reference is required"
Location Required	Location reference mandatory	"Location is required"
Type Required	Encounter type mandatory	"Encounter type is required"
partOf (Consultation)	Consultation must reference parent Visit	"partOf reference to Visit required"
Transfer Origin/Dest	Transfer must have origin and destination	"Transfer requires origin and destination"

Observation Validations

Rule	Description	Error Message
Encounter Required	Encounter reference mandatory	"Encounter reference is required"
Value Not N/A	Value cannot be "N/A"	"Value cannot be N/A"
Subject Required	Patient reference mandatory	"Subject is required"
Performer Required	Practitioner reference mandatory	"Performer is required"
Category Required	Category based on type (vital-signs, laboratory, survey)	"Category is required"
Code System	LOINC for lab results and vital signs	"Invalid code system"

AllergyIntolerance Validations

Rule	Description	Error Message
Clinical Status	Required (active, inactive, resolved)	"Clinical status is required"
Verification Status	Required (unconfirmed, confirmed, refuted)	"Verification status is required"
Patient Required	Patient reference required	"Patient reference is required"
Code Required	Allergy code mandatory	"Allergy code is required"
RecordedDate	Mandatory	"RecordedDate is required"
OnsetDateTime	Mandatory	"OnsetDateTime is required"
Location	Required via extension	"Location reference is required"

Immunization Validations

Rule	Description	Error Message
Status	Required (completed, not-done)	"Status is required"
Vaccine Code	NPC code required	"Vaccine code is required"
Patient Required	Patient reference required	"Patient reference is required"
Occurrence Date	Not in future, required	"Occurrence date cannot be future"
Performer Required	Practitioner required	"Performer is required"
Location Required	Location required	"Location is required"
Encounter Optional	Encounter NOT mandatory	N/A

ServiceRequest Validations (Lab/Imaging)

Rule	Description	Error Message
Status	Required (active, completed, etc.)	"Status is required"
Intent	Required (order)	"Intent is required"
Category	Lab: 108252007, Imaging: 363679005	"Invalid category code"
Code	SNOMED CT code required	"Code is required"
Subject Required	Patient reference required	"Subject is required"
Occurrence Date	Not future, mandatory	"Occurrence date cannot be future"
Requester	Practitioner required	"Requester is required"
Performer	Practitioner required	"Performer is required"
Location	Required	"Location is required"

Condition Validations

Rule	Description	Error Message
Clinical Status	Required (active, resolved, recurrence, remission)	"Clinical status is required"
Verification Status	Required (unconfirmed, provisional, differential, confirmed)	"Verification status is required"
Code	ICD-11 code required	"Condition code is required"
Subject Required	Patient reference mandatory	"Subject is required"
Asserter Required	Practitioner mandatory	"Asserter is required"

Procedure Validations

Rule	Description	Error Message
Status	Required (completed default)	"Status is required"
Code	ICHI code required	"Procedure code is required"
Subject Required	Patient reference required	"Subject is required"
Performed Date	Not future, required	"Performed date cannot be future"
Performer	Practitioner required	"Performer is required"
Location	Required	"Location is required"

Medication Validations

Rule	Description	Error Message
Status	Required (active, stopped, completed)	"Status is required"
Code	SNOMED CT code required	"Medication code is required"
Subject Required	Patient reference required	"Subject is required"
Performer/Actor	Practitioner required	"Performer is required"
Location	Required via extension	"Location is required"
Dosage	Route, method, dose mandatory	"Dosage information is required"
Date/Time	Mandatory, not future for admin	"Date/time is required"

Consent Validations

Rule	Description	Error Message
Status	Required (draft, proposed, active, rejected, inactive)	"Status is required"
Scope	Required (patient-privacy, treatment, research)	"Scope is required"
Category	Mandatory	"Category is required"
Patient Required	Patient reference mandatory	"Patient reference is required"
DateTime	Mandatory	"DateTime is required"

CODE SYSTEMS & TERMINOLOGIES

Primary Code Systems

System	Purpose	URL	Example
LOINC	Lab tests, Vital signs	http://loinc.org	8480-6 (Systolic BP)
SNOMED CT	Clinical terms, Medications	http://snomed.info/sct	372756006 (Amoxicillin)
ICD-11	Diagnoses	https://icd.who.int	1F42 (Malaria)
ICHI	Procedures	http://www.ichi.org/	18629005 (Vaccine admin)
NPC	Rwanda National Pharmacy Code	http://npc.rw	227493005 (Penicillin)
DICOM	Imaging modalities	https://dicom.nema.org/	XA (X-Ray Angiography)

Encounter Class Codes

Code	Display	Description
AMB	Ambulatory	Outpatient visit
EMER	Emergency	Emergency visit
IMP	Inpatient	Hospital admission
HH	Home Health	Home care visit

Encounter Type Codes

Code	Description
VISIT_ENCOUNTER	Initial visit/registration
CONSULTATION_ENCOUNTER	Clinical consultation
TRANSFER_ENCOUNTER	Patient transfer

Observation Category Codes

Code	Usage
vital-signs	Vital signs measurements
laboratory	Lab test results
survey	Questionnaires, chief complaints
exam	Physical examination findings
social-history	Social history observations

Medication Status Codes

Resource	Status Values
MedicationRequest	active, on-hold, cancelled, completed, entered-in-error, stopped, draft, unknown
MedicationDispense	preparation, in-progress, cancelled, on-hold, completed, entered-in-error, stopped, declined, unknown
MedicationAdministration	in-progress, not-done, on-hold, completed, entered-in-error, stopped, unknown

INTEGRATION PATTERNS

Pattern 1: Complete Patient Registration Flow

```
// Step 1: Check if patient exists in Client Registry
GET http://197.243.24.138:5001/cr/Patient?identifier=251119-0001-4106

// Step 2: If not found, get demographics from NIDA
POST http://197.243.24.138:5001/api/v1/citizens/getCitizen
{
  "fosaid": "0001",
  "documentType": "NID",
  "documentNumber": "1192880005226000"
}

// Step 3: Create patient in Client Registry
POST http://197.243.24.138:5001/cr/Patient
{
  "resourceType": "Patient",
  "id": "251119-0001-4106",
  // ... patient data from NIDA
}

// Step 4: Create Visit Encounter in SHR
POST http://10.10.69.42:9096/shr/Encounter
{
```

```
"resourceType": "Encounter",
"type": [{"coding": [{"display": "VISIT_ENCOUNTER"}]}],
// ... encounter data
}
```

Pattern 2: E-Prescription with Multiple Medications

```
// Prescription with 3 medications
const prescriptionCode = "PR-2025-11-20-001";

// Medication 1
POST /MedicationRequest
{
  "groupIdIdentifier": {
    "value": prescriptionCode
  },
  "medicationCodeableConcept": {
    "coding": [{"code": "372756006", "display": "Amoxicillin"}]
  }
}

// Medication 2
POST /MedicationRequest
{
  "groupIdIdentifier": {
    "value": prescriptionCode
  },
  "medicationCodeableConcept": {
    "coding": [{"code": "387517004", "display": "Paracetamol"}]
  }
}

// Medication 3
POST /MedicationRequest
{
  "groupIdIdentifier": {
    "value": prescriptionCode
  },
  "medicationCodeableConcept": {
    "coding": [{"code": "318341008", "display": "Ibuprofen"}]
  }
}
```

```
// All three share the same groupIdIdentifier = prescription
```

Pattern 3: Lab Order → Results Flow

```
// Step 1: Doctor orders lab test
POST /ServiceRequest
{
  "resourceType": "ServiceRequest",
  "status": "active",
  "intent": "order",
  "category": {"coding": [{"code": "108252007"}]},
  "code": {"coding": [{"code": "15220000", "display": "Full
Blood Count"}]},
  "subject": {"reference": "Patient/251119-0001-4106"},
  "encounter": {"reference": "Encounter/visit-id"}
}

// Step 2: Lab technician enters results
POST /Observation
{
  "resourceType": "Observation",
  "status": "final",
  "category": [{"coding": [{"code": "laboratory"}]}],
  "code": {"coding": [{"system": "http://loinc.org", "code":
"33747-0"}]},
  "subject": {"reference": "Patient/251119-0001-4106"},
  "encounter": {"reference": "Encounter/visit-id"},
  "valueQuantity": {"value": 160, "unit": "mmHg"}
}
```

Pattern 4: Complete Clinical Visit

```
// 1. Create Visit Encounter
POST /Encounter (VISIT_ENCOUNTER)

// 2. Record Vital Signs
POST /Observation (vital-signs category)
- Blood Pressure
- Temperature
- Heart Rate
```



```
// 3. Create Consultation Encounter (child of Visit)
POST /Encounter (CONSULTATION_ENCOUNTER with partOf)

// 4. Record Chief Complaints
POST /Observation (survey category)

// 5. Order Investigations
POST /ServiceRequest (Lab order)
POST /ServiceRequest (Imaging order)

// 6. Enter Diagnosis
POST /Condition

// 7. Prescribe Medications
POST /MedicationRequest (with groupIdentifier)

// 8. Record Procedures
POST /Procedure

// 9. Update Visit Encounter
PUT /Encounter/{visit-id}
{
  "status": "finished",
  "period": {
    "start": "2025-11-19T13:35:35+02:00",
    "end": "2025-11-19T15:45:00+02:00"
  }
}
```

ERROR HANDLING

HTTP Status Codes

Code	Meaning	Common Causes
200	OK	Successful GET request
201	Created	Successful POST (resource created)
204	No Content	Successful DELETE
400	Bad Request	Invalid JSON, validation failure
401	Unauthorized	Missing/invalid authentication
404	Not Found	Resource doesn't exist
409	Conflict	Duplicate resource
422	Unprocessable Entity	Business logic validation failure
500	Internal Server Error	Server-side error

Error Response Format

```
{
  "resourceType": "OperationOutcome",
  "issue": [
    {
      "severity": "error",
      "code": "invalid",
      "diagnostics": "Patient reference is required",
      "expression": ["subject"]
    }
  ]
}
```

Common Errors & Solutions

Error: "Invalid UPID format"

Cause: UPID doesn't match pattern `YYMMDD-FOSAID-RAND4`

Solution: Use UPID from Client Registry/UPID Generator

Error: "Reference could not be resolved"

Cause: Referenced resource doesn't exist

Solution: Ensure referenced Patient/Encounter/Practitioner/Location exists first

Error: "Birth date cannot be future dated"

Cause: birthDate is after current date

Solution: Use correct historical date

Error: "Encounter reference is required"

Cause: Observation missing encounter reference

Solution: Add encounter reference to all observations

Error: "Cannot create encounter for deceased patient"

Cause: Attempting to create encounter after patient's death

Solution: Check patient deceased status before creating encounters

Error: "Value cannot be N/A"

Cause: Observation value set to "N/A"

Solution: Either provide actual value or don't create observation

BEST PRACTICES

1. Resource Ordering

Always create resources in this order:

1. Patient (if not exists)
2. Consent
3. Visit Encounter
4. Vital Signs Observations

5. Consultation Encounter (with partOf to Visit)
6. Consultation Observations
7. Service Requests (Lab/Imaging orders)
8. Conditions (Diagnoses)
9. Procedures
10. MedicationRequests (grouped by prescription)
11. Lab Results Observations
12. ImagingStudies
13. MedicationDispense
14. MedicationAdministration
15. Transfer Encounter (if needed)

2. UUID Generation

Generate UUIDs for all resource IDs:

```
// JavaScript
const uuid = crypto.randomUUID();

// Python
import uuid
resource_id = str(uuid.uuid4())

// Java
import java.util.UUID;
String uuid = UUID.randomUUID().toString();
```

3. Date/Time Formatting

Always use ISO 8601 format:

YYYY-MM-DD (date only)

YYYY-MM-DDTHH:mm:ss+00:00 (date-time with timezone)

Examples:

2025-11-18

2025-11-18T10:18:07+02:00

4. Reference Management

Use consistent reference format:

```
{  
  "reference": "ResourceType/resource-id",  
  "type": "ResourceType",  
  "display": "Human readable name"  
}
```

5. Search Optimization

Use specific search parameters:

```
// Good - specific search  
GET /Patient?identifier=251119-0001-4106  
  
// Bad - broad search  
GET /Patient?_content=MUGISHA  
  
// Good - with pagination  
GET /Encounter?patient=251119-0001-4106&_count=20&page=1  
  
// Good - date range  
GET /Observation?date=ge2025-01-01&date=le2025-12-31
```

Testing Tools

1. Postman: Import the provided collection
2. cURL: Command-line testing

3. HAPI FHIR Validator: Validate resources before submission

Debug Checklist

- ☐ Authentication credentials correct?
 - ☐ Content-Type header set to `application/fhir+json`?
 - ☐ All required fields present?
 - ☐ References point to existing resources?
 - ☐ Date/time in ISO 8601 format?
 - ☐ UPID format valid?
 - ☐ No future dates for historical events?
 - ☐ Code systems correct (LOINC, SNOMED, ICD-11)?
-

APPENDIX

A. Quick Reference Card

Task	Endpoint	Method
Search Patient	<code>/Patient?identifier={upid}</code>	GET
Create Patient	<code>/Patient</code>	POST
Create Visit	<code>/Encounter</code>	POST
Record Vitals	<code>/Observation</code>	POST
Create Consultation	<code>/Encounter</code> (with partOf)	POST
Order Lab	<code>/ServiceRequest</code>	POST
Enter Lab Results	<code>/Observation</code>	POST
Add Diagnosis	<code>/Condition</code>	POST
Prescribe Medication	<code>/MedicationRequest</code>	POST
Record Procedure	<code>/Procedure</code>	POST
Create Transfer	<code>/Encounter</code> (transfer type)	POST
Get IPS	<code>/Bundle/\$ips?patient={id}</code>	GET

B. Important URLs

- SHR Base: `{BASE_URL}:{PORT}/shr/`
- Client Registry: `{BASE_URL}:{PORT}/cr/`
- UPID Generator: `{BASE_URL}:{PORT}/api/v1/citizens/`
- SHR - FHIR Capability Statement: `{BASE_URL}:{PORT}/shr/metadata`

C. Support & Documentation

- FHIR R4 Specification: <https://hl7.org/fhir/R4/>
- HAPI FHIR Documentation: <https://hapifhir.io/>
- LOINC: <https://loinc.org/>
- SNOMED CT: <https://www.snomed.org/>

- ICD-11: <https://icd.who.int/>

D. Glossary

Term	Definition
CR	Client Registry - Patient demographic registry
EMR	Electronic Medical Record system
FHIR	Fast Healthcare Interoperability Resources
FOSAID	Facility ID
ICD	International Classification of Diseases
ICHI	International Classification of Health Interventions
IPS	International Patient Summary
LOINC	Logical Observation Identifiers Names and Codes
NID	National ID
NIDA	National Identification Agency
NPC	National Pharmacy Code
RHIE	Rwanda Health Information Exchange
SHR	Shared Health Record
SNOMED CT	Systematized Nomenclature of Medicine Clinical Terms
UPID	Unique Patient Identifier
UUID	Universally Unique Identifier

VERSION HISTORY

Version	Date	Changes
1.0.0	November 2023	Initial release
2.0.0	November 2025	second release with enhancements

CONTACT & SUPPORT

For technical support or questions about RHIE integration:

- Email: digitalization@moh.gov.rw
- Documentation: coming soon
- Issue Tracker: coming soon

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