# About this document

This document is intended for participants to learn identifying FHIR resources to be used. Effort has been taken to make the story depicted close to a real-life story. All data mentioned in this document are fictional.

## How to use the document

Read the complete patient story. For each section of the patient story, do the following steps:

1. Identify the FHIR Resources
2. Within a resource,
   1. Identify the fields to capture the data given.
   2. If a field needs to be codified, identify the medical dictionary and code that needs to be used. Medical Dictionary examples: ICD code for diagnosis; LOINC for diagnostic procedures and observations; CPT for procedures.
3. Take a decision if there is a need to encode data into separate resources or into a single bundle. If the decision is to use a bundle, identify the bundle type.
4. Create FHIR JSONs and post them to a FHIR Server. For this step ensure that you add the master data as mentioned in the next section before adding transactions.

# Master Data - Organization

|  |  |
| --- | --- |
| **Attribute** | **Sample Data** |
| Identifier | HSP20240428 |
| Name | Get Well Soon Hospital |
| Address → Line | 4403 Green Street |
| Address → City | Bangalore |
| Address → State | Karnataka |
| Address → Country | India |
| Contact → Phone | 080 4134 4523 |
| Contact → Email | getwellsoonhospital@example.com |

# Patient Story

## Registration/Reception Desk

**A 47-year-old male named Ravindranath** a native resident of **Krishnagiri, Tamil Nadu**, a lorry driver by profession was traveling to Bangalore when he experienced sudden onset of chest pain and decided to visit a doctor in **“Get Well Soon Hospital”** Bangalore, Karnataka.

The receptionist **Ms. Devika** registered Ravindranath as a new patient and entered the following information in the Hospital Information System (HIS)

|  |  |
| --- | --- |
| Attribute | Data |
| First Name | Ravindranath |
| Last Name | Krishnagiri |
| Date of Birth | 25-October-1974 |
| Gender | Male |
| Driving License Number | TN-18-ERV2SAWY5R |
| Address → Line 1  Address → Line 2  Address → City  Address → State  Address → Pin code | 201/5G, Indira Nagar, Phase 2  Kathujuganapalli  Krishnagiri  Tamil Nadu  635001 |

The HIS generated an ID card for Ravindranath bearing Medical Record Number “GWSH-BLR-2404281842”

When receptionist **Ms. Devika** enquired about the reason for the visit, patient Ravindranath replied, “I have been suffering from chest pain for the past 2 days”. The receptionist created a visit with **Dr. Siddharth** with “**Chest Pain from 2 days**” as the chief complaint. The HIS generated a visit number “**20240428-0384**”. The receptionist asked patient Ravindranath to wait in the outpatient waiting area.

## Nursing Station

At the outpatient waiting area the OPD nurse **Mrs. Lavanya** called patient **Ravindranath** into the nursing station and collected the following vitals.

|  |  |
| --- | --- |
| **Attribute** | **Data** |
| Blood Pressure - Systolic | 180 mmHg |
| Blood Pressure - Diastolic | 106 mmHg |
| Heart Rate | 102 beats per minute |
| Oxygen Saturation | 97% |
| Body Temperature | 37.2℃ |

When nurse **Mrs. Lavanya** asked patient Ravindranath to describe the problem, the patient explained about the chest pain for the previous two days and it was increasing with time. The patient described the pain growing from the chest area and radiating to the left arm. When the nurse (Mrs. Lavanya) asked about any dental treatment or surgeries, the patient responded that he went through a **tooth extraction three years ago.**

After which the nurse asked about the family history and disorders such as cardiac issues, diabetes, hypertension or other related issues. Patient Ravindranath replied about his **mother being diabetic**.

When the nurse enquired about his lifestyle, the patient provided information about the smoking habits and he smokes around 20 cigarettes daily, and he has been **a smoker** for the **past 18 years.**

After that she recorded the details in the patient's history and asked him if he has any allergies or a history of any surgeries or if he’s on any medication, where Ravindranath answered that he is allergic to penicillin and is not on any medications recently.

## Doctor’s Office

Once the vitals were done Ravindranath was sent to the waiting area to visit the doctor. After 15 minutes Ravindranath got his turn and went to the doctor’s cabin where **Dr. Siddharth** introduced himself to Ravindranath and asked about the problem, then he explained about chest pain from 2 days, and has increased severely today, and he feels as if **“an elephant is sitting on his chest”.**

The doctor started the review of systems where he started observing the eye and tongue for any infection and checked nails for clubbing and observed Ravindranath for any scars over the skin. After observing the patient Dr. Siddharth created the following Subjective, Objective, Assessment and Plan (SOAP) note:

| **Attribute** | **Data** |
| --- | --- |
| Subjective | The patient, Ravindra, a 47-year-old male, presents with complaints of severe chest pain that started approximately 2 days ago. The pain is described as crushing and radiating to the left arm. The patient rates pain as 8/10 on the pain scale.  Patients also report feeling nauseous and diaphoretic. The patient denies any recent trauma or injury but admits to a history of smoking. Patient expresses fear and anxiety regarding the current episode of chest pain. |
| Objective | Vitals Signs   * Blood Pressure - Systolic: 180 mmHg * Blood Pressure - Diastolic: 106 mmHg * Heart Rate: 102 beats per minute * Oxygen Saturation: 97% * Body Temperature: 37.2 ℃   General Appearance:   * Patient appears anxious and diaphoretic.   Cardiac Exam:   * Heart sounds are regular, with no murmurs, gallops, or rubs. * Jugular venous distension is not noted. * No lower extremity edema is observed.   Respiratory Exam:   * Breath sounds are clear bilaterally.   Neurological Exam:   * Patient is alert and oriented, with no focal neurological deficits. |
| Assessment | Based on the patient's clinical presentation of severe chest pain, radiating to the left arm, associated with diaphoresis and nausea, ACS is suspected. Initial Dx Code: I20.9 Angina pectoris, unspecified  Risk Factors:   * Hypertension * Hyperlipidemia * Smoking |
| Plan | Further Evaluation. (Requisition ID: R587439)   * ECG → Cath Lab (Order ID: R587439-001) * CBC → Clinical Laboratory (Order ID: R587439-002) * Troponin I -> Clinical Laboratory (Order ID: R7587439-003) * Troponin T → Clinical Laboratory (Order ID: R587439-004) * 2 D Echo -> Cathlab (Order ID: R587439-005) * Myocardial Perfusion → Imaging (Order ID: R587439-006) |

## **CATH Lab Department**

### ECG

On reading the prescription of Dr. Siddharth for an **ECG**, patient Ravindranath was directed to go to the Cath Lab. The patient was asked to change into a hospital robe and thereafter six electrodes were placed on the chest as shown below.

A diagram of a human skeleton

Description automatically generatedAfter conducting the ECG procedure, patient Ravindranath was advised to move to the next room for conducting the 2D echo procedure.

The cath-lab doctor viewed the ECG and noted that the ***“ECG has S-T segment depression ≥ 0.5 mm, New T wave inversion ≥ 2.0 mm in more than 2 contiguous leads which was abnormal to the natural ECG reading”***.

### 2D ECHO

Patient Ravindranath was made to lie down on a table. Technician Gautam applied a gel to the chest area to enhance ultrasound transmission. A transducer, emitting high-frequency sound waves, was placed on various points of the chest, capturing images of the heart in real-time. These images were displayed on a monitor and provided detailed views of the heart's chambers, valves, and blood flow patterns. The technician used doppler ultrasound to evaluate the direction and speed of blood flow within the heart and blood vessels.

Patient Ravindranath was advised to change to his regular clothes and move to the sample collection room to provide blood samples.

The cath-lab doctor viewed the images and noted that ***“Regional wall motion abnormality in the anterior septal aspect of the Heart”***.

**Lab Sample Collection Counter**

As Ravindranath reached the sample collection room the phlebotomist searched for pending orders in Laboratory Information System (LIS) and saw that two orders were transmitted from HIS. **Phlebotomist Deepak** makes patient Ravindranath sit comfortably on a couch and blood samples are drawn from the patient’s left arm and collected into a Lavender-top (EDTA), Green top (lithium-heparin) tubes. Labels were generated in the LIS as mentioned below:

|  |  |  |  |
| --- | --- | --- | --- |
| Order ID | Accession Number | Container Type | Sample Volume |
| R587439-002 | 87349301 | Lavender Top | 3 ml |
| R587439-003  R587439-004 | 87349302 | Green Top | 2 ml |

The samples collected there by the phlebotomist were placed into the NMR tube carrier and the samples were sent through a pneumatic tube to the laboratory. LIS transmits the accession numbers with the order references to HIS. Ravindranath was asked to visit the radiology department as the patient had been scheduled for the **Myocardial Perfusion Imaging procedure.**

## Radiology Department

Upon Ravindranath reaching the radiology department, the radiology receptionist Rohan searches for pending orders in the Radiology Information System (RIS). He sees that the Myocardial Perfusion → Imaging (Order ID: R587439-006) has been transmitted from HIS. The patient is directed to see nurse Akanksha in the initial screening section.

Nurse Akankshaenquired patient Ravindranath if he had undergone any previous scans or if he was under any medication like beta-blockers. The nurse checked the patient pulse rate of Ravindranath which was found to be 101 bpm. Patient Ravindranath is asked to fill in and sign a consent form for the procedure.

After 20 minutes of waiting time, the patient is asked to move to the changing room and has been told to change into the hospital gown and remove all metal objects such as rings and chains from his body as it would interrupt the imaging process.

Mr. Manish the technician makes the patient lie on the MRI gurney and moves to the control room of MRI. The procedure takes around 25 minutes. The radiologist Surendranath views the images and prepares and transmits the following report to HIS.

| **Radiology Report** |
| --- |
| **Procedure:** Myocardial Perfusion Imaging |
| **Indication:** Evaluation of myocardial perfusion and ischemia in a patient with suspected coronary artery disease. |
| **Technique:** Rest/stress myocardial perfusion imaging was performed using technetium-99m Sestamibi. Images were acquired at rest and during peak pharmacological stress induced by adenosine infusion. Stress was achieved to 85% of the age-predicted maximum heart rate. Single-photon emission computed tomography (SPECT) imaging was performed using a dual-head gamma camera system. |
| **Findings:**  Rest Perfusion Imaging:   * There is no evidence of perfusion defects at rest. * The left ventricular wall motion is normal at rest.   Stress Perfusion Imaging:  Substantial reversible perfusion defects noted in the mid to apical anterior, anterolateral, and inferolateral walls, consistent with inducible ischemia.   * There is a corresponding regional wall motion abnormality noted in the same segments, indicative of myocardial ischemia. |
| Conclusion:  The myocardial perfusion imaging demonstrates significant inducible ischemia involving the mid to apical anterior, anterolateral, and inferolateral walls. This finding suggests the presence of significant coronary artery disease with associated ischemia. Clinical correlation and further evaluation with coronary angiography are recommended for definitive diagnosis and management planning. |
| Impression:   1. Moderate to severe inducible ischemia involving the mid to apical anterior, anterolateral, and inferolateral walls. 2. No evidence of resting perfusion defects. 3. Normal left ventricular wall motion at rest. |
| Interpretation By: Surendranath, MCI ID: MH/75395/35412 |

After a period of rest, the patient is instructed to go back to the OPD waiting room and visit the doctor.

## Doctor's Office

In due course of time, the LIS and RIS systems have transmitted the Lab and Radiology reports to HIS.

When the patient arrives back at Dr. Siddharth’s cabin, the doctor pulls out the reports from HIS, and interprets that patient Ravindranath has **Acute Coronary Syndrome.**

WMR (platelet-activity) had the highest discriminative ability amongst all CBC parameters which may be used as a prognostic marker in patients with ACS.

Ravindranath has an elevated WMR(WMR>1000) in the CBC report, which was associated with a substantial rise in the risk of MACE (major adverse cardiovascular events), and is the most accurate marker amongst all CBC components in predicting ACS.for further confirmation Ravindranath also went through Troponin tests as prescribed by Dr. Siddharth and the interpretations were done by the doctor as:

The laboratory results were reported as positive in Ravindranath’s case with a value of 0.06 ng/mL which was just above the diagnostic limit of 0.04 ng/mL.

The results of cTn testing often guide the decision for coronary intervention and the reports were positive in Ravindranath’s case indicating there was damage in the coronary artery.

Dr. Siddharth also described about how his smoking habit will be contributing to the elevation of his condition, and asked him to stop smoking in order to get better outcome from the treatment, he also explained that due to genetic factor he is more prone to diabetics and that his habit will interfere with the medications that he is going to be prescribed with.

After explaining all the details, Dr. Siddharth prescribed Ravindranath with the medication and also asked the patient to come back for a follow-up session after three days.

## Pharmacy

From the doctor’s cabin Ravindranath goes to the pharmacy in the hospital. Pharmacist **Ms. Niharika** searches for the prescriptions for the patient and views that Dr. Siddharth has prescribed patient Ravindranath with Statins (Lipitor-20mg) which are used to lower the amount of free cholesterol in blood, and beta blockers (Toprol XL-25mg) to help relax the heart muscles.

The patient has also been prescribed Aspirin (300mg) and a sublingual spray of glyceryl trinitrate (GTN) to be used as “Emergency Medication”.

After collecting all the medications, Ms. Niharika explains to patient Ravindranath about the process of administering regular medications and also explains when the emergency medication has to be used and how to be administered.