

# Common Lab Module

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## Overview

This is a simple module, which can be used to create and customise forms to manage patients' laboratory test orders, samples and results.

## Features

The module provides RESTful API and legacy OpenMRS interface, it provides:

1. Administrative forms to create new Lab tests and define their set of results.
2. Separate tab on patient's dashboard to create Lab test orders
3. Collect and manage specimen samples (if required) to process
4. Enter test results
5. Attach scanned/documentated reference files for test results

## Module Structure

The module is structured according to OpenMRS conventions found [here](#).

### API

`src/main/java/org.openmrs.module.commonlabtest.api.impl/CommonLabTestServiceImpl` implements **CommonLabTestService** which extends **OpenmrsService**.

The unit tests can be found in

`src/test/java/org.openmrs.module.commonlabtest` package

`src/test/resources/CommonLabTestService-initialData.xml` contains the test data

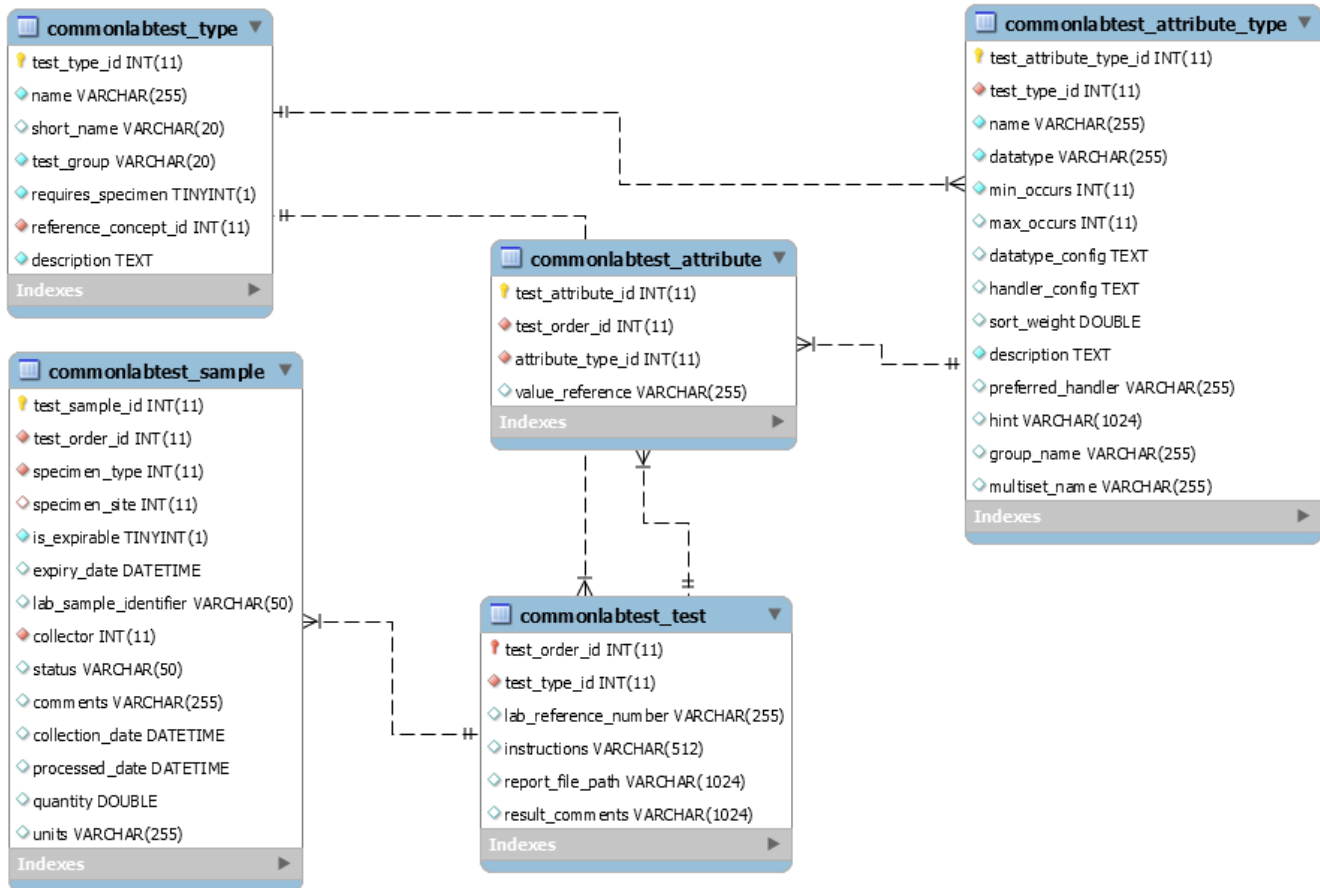
### OMOD

`src/main/java/org.openmrs.module.commonlabtest.web.controller/...` contains all Controllers for web app

`src/main/java/org.openmrs.module.commonlabtest.web.resource/...` contains all REST controllers

`src/main/webapp/...` contains the JSP files and related resources

### Data Model



The **LabTestType** maps to **commonlabtest\_type**, where all lab test types are stored, for example CD4 test, CBC test, Ultrasound test.

**LabTestAttributeType** maps to **commonlabtest\_attribute\_type**; against each **LabTestType** object a set of **LabTestAttributeType** is meant to be created, each representing an observation which will be captured when entering results. For example, for CBC test, some **LabTestAttributeType** can be RBC count, WBC count, Haemoglobin and Platelets.

A **LabTest** object maps to **commonlabtest\_test** extends OpenMRS object, each patient lab test is referred by this object. This object contains a mandatory **Order** object, which is abstract OpenMRS object used for Lab tests and Drug orders.

**LabTestSample** object, which maps to **commonlabtest\_sample** table, contains specimen samples (if the associated **LabTestType** requires a sample to process a test).

Test results for **LabTest** object are stored in **LabTestAttribute** (extends **BaseAttribute** abstract class) objects, which map to **commonlabtest\_attribute**. An important thing to note here is that an attribute's value might be open-text, numeric, concept, drug, or even a location. The **value\_reference** column contains the reference of the actual value. The Service API returns the associated object, while the RESTful API returns the reference value only.

*The best documentation for developers is test cases. Check out the examples in unit tests for complete details. 😊*

## Setup

The module requires OpenMRS version 2.0.x or higher and Legacy UI module as prerequisite.

On installing the module, some data is created in the database:


- Privileges: Add/Edit/Delete/View CommonLabTest Metadata, CommonLabTest Orders and CommonLabTest results
- A concept (if one does not exist) named UNKNOWN LAB TEST TYPE (uuid b095450e-9ad0-11e8-844c-448a5b471032)
- Default LabTestType: Unknown Test Type (uuid ee9b140e-9a29-11e8-a296-40b034c3cfee)

## Global Properties

Following are the global properties that are created on installing the module:

- `commonlabtest.fileExtensions` refers to the types of files that can be saved as attachments.

- `commonlabtest.fileDirectory` refers to the directory that holds the uploaded attachments (located in OpenMRS application directory as ... /complex\_obs/commonLabTestFiles).
- `commonlabtest.specimenTypeConceptUuid = 162476AAAAAAAAAAAAAAAAAAAAAAAAAAAA` refers to the different types of samples, for example plasma etc.
- `commonlabtest.specimenSiteConceptUuid = 159959AAAAAAAAAAAAAAAAAAAAAAAAAAAA` refers to the source of collected sample, for example pulmonary tissue etc.
- `commonlabtest.testunitsConceptUuid = 5db4f53e-6218-4ae0-ae4e-5e0343b5d30` refers to the units in which sample can be quantified.

 **Global Properties**

Please note if the global properties are not set up then errors may be encountered while using module. Therefore, setting up global properties is a required step (ideally should be automatically done during installation of module).

## Usage

This section describes

- how to configure metadata
- basic workflow of module from requesting an order to filling test results
- sample management

## Configuring Metadata

Apart from configuring global properties, there are two types of metadata objects that should be created before using Common Lab Module. Those are Lab Test Types and Lab Test Attribute Types as explained in detail below.

### Lab Test Types

*Lab Test Types* refer to the type of tests for which the orders can be requested, for example CXR, AFB Smear etc. On main *Administration* page under the heading of Common Lab Test, *Manage Test Types* redirects to the page that manages information related to all the test types.

**Add Test Type**

Reference Concept \*

Test Name \*

Short Name

Description

Test Group

Requires Specimen  Yes  No

On *Add Test Type* page, each Test Type is linked with a reference concept for example, CXR Test type should have a reference concept object (concept name does not necessarily need to match, it can be CHEST X-RAY or CXR etc.). Test Group refers to the the group to which this test belongs. Group is an enum list containing test groups like Serology, Cardiology, Ophthalmology, Bacteriology, Biochemistry, Blood\_Bank, Cytology, Hematology, Immunology, Microbiology, Radiology, Sonology, Urinalysis and Other. Last question *Requires Specimen* denotes that test type either requires or doesn't require specimen to produce results. *Manage Test types* is updated after test type is created successfully.

Admin | [Manage Test Types](#) | [Manage Attribute Types](#)

## Manage Test Types

+ Add Test Type

List Test Types

Show 10 entries Search:

Name	Short Name	Test Group	Reference Concept	Linked Attribute Types
<input checked="" type="checkbox"/> AFB Culture	culture_done	BACTERIOLOGY	CULTURE FOR MYCOBACTERIA	
<input checked="" type="checkbox"/> AFB Culture Dst	afb_culture_dst	BACTERIOLOGY	AFB CULTURE DST	
<input checked="" type="checkbox"/> Afb Smear	afb_smear	BACTERIOLOGY	AFB SMEAR	
<input checked="" type="checkbox"/> Audiometry	audiometry	SONOLOGY	AUDIOMETRY	
<input checked="" type="checkbox"/> CBC	refer_cbc	HEMATOLOGY	REFERRED CBC	

## Lab Test Attribute Types

Lab Test Attribute types basically serve as the questions that constitute the details of a Lab Test Result. Values against these Test Attribute Types are saved while submitting Test Results. These attribute types can be created from the option *Manage Attribute Types* on Administration page.

### Add Attribute Type

Lab Test Type \*

Name \*

Description \*

Multiset Name

Group Name

Min Occurs \*

Max Occurs \*

Sort Weight \*  [Sort Weight hierarchy](#)

Data Type

Datatype Configuration

Preferred Handler

Handler Configuration

On Add Attribute Type page, there are multiple fields that are described below:

- Lab Test Type:** Attribute Types are created against Lab Tests therefore, this field refers to the test type to which the new attribute type belongs.
- Name:** It holds the name assigned to the Attribute type.
- Description:** Any additional information/description is filled in this field.
- Multiset Name:** If the question asked in the test can have multiple answers, then for each answer an attribute type is created. But all of these answer Attribute Types should have same Multiset Name. Please see the example below.

**Edit Attribute Type**

Lab Test Type \*

Name \*

Description \*

Multiset Name

Group Name

Min Occurs \*

Max Occurs \*

Sort Weight \*  Sort Weight hierarchy

Data Type  Configuration is not used

Datatype Configuration

Preferred Handler

Handler Configuration

**Edit Attribute Type**

Lab Test Type \*

Name \*

Description \*

Multiset Name

Group Name

Min Occurs \*

Max Occurs \*

Sort Weight \*  Sort Weight hierarchy

Data Type  Configuration is not used

Datatype Configuration

Preferred Handler

**Kanamycin**

Wild Type Band Failed

Mutation Band Developed  MUT 1  
 MUT 2  
 No } **Multi select questions on Test Result page**

- Group Name:** Group name refers to group of questions listed under a single heading. Like in above example, **Kanamycin** contains a group of questions (Wild Type Band Failed and Mutation Band Developed). Therefore, they are listed under single heading **Kanamycin**.
- Min Occurs:** It refers to the minimum occurrence of an attribute type in a test result.
- Max Occurs:** It refers to the maximum occurrence of an attribute type in a test result.
- Sort Weight:** It refers to the sequence number in which attribute types (question) will appear in test result form.
- Data Type:** It refers to the datatype assigned to attribute type. These are the supported data types: Boolean, Long Free Text, Float, Concept, Regex Validated Text, Free Text, Date. Concept datatype is assigned to attribute types that are closed ended questions for example, question for confirmation of cough has Yes, No, Unknown, Refused options as answers. Therefore, such attribute type will be created with Datatype Concept.
- Datatype Configuration:** In case of an attribute type with Concept datatype, concept ID should be mentioned in the datatype configuration field. In case of Text, Regex Validated Text, Float values, DataType configuration can be used to mention Length or Regex or Range. Please see example below.
- Hint:** It is used to mentioned any additional info. For example, if only numeric value is allowed in float datatype then hint can be filled as "Numeric value with max length 2". It will appear with the question on the Test Result form.
- Preferred Handler:** Should be kept as **Default**.
- Handler Configuration:** Should be left as blank.

Min Occurs \*

Max Occurs \*

Sort Weight \*  [Sort Weight hierarchy](#)

Data Type  Configuration is not used

Regex  Length  Range

Datatype Configuration

Hint

Preferred Handler

## Workflow

On installing module, there is a new tab *Lab Tests* created on patient dashboard. In *Lab Tests* tab, there are two options available (*Add Test Order* & *Add Test Request*).

**Harry James Potter** Patient ID: **THY5Q-0**  
 38 yrs ( Jul 31, 1980) Test Patient: true Primary Phone Number: 03452345345 Mother Name: Lily Potter National ID: 42101-1234567-8 External ID: 201704210024

BMI: 26.4 ( Weight: 62.0 kg , Height: 153.0 cm ) registration\_date: Regimen:

Active Visit: [Facility Visit](#) from 07/31/2018 [Edit Visit](#) [End Visit](#)  
 No encounters yet

Overview Visits Demographics Graphs Form Entry Medications **Lab Tests**

+ Add Test Order + Add Test Request

**List Test Order**

Show 10 entries Search:

Test Type	Lab Reference Number	View	Edit	Manage Test Sample	Test Result
No data available in table					

Showing 0 to 0 of 0 entries [Previous](#) [Next](#)

*Add Test Order* refers to single Test order request whereas *Add Test Request* can be used for creating multiple Test order requests at a time. Additionally, in this tab there is a list of Test Orders requested for that patient. *Add Test Order* directs to the following page.

**Harry James Potter** Patient ID: **THY5Q-0**  
 38 yrs ( Jul 31, 1980) Test Patient: true Primary Phone Number: 03452345345 Mother Name: Lily Potter National ID: 42101-1234567-8 External ID: 201704210024

BMI: 26.4 ( Weight: 62.0 kg , Height: 153.0 cm ) registration\_date: Regimen:

Active Visit: [Facility Visit](#) from 07/31/2018 [Edit Visit](#) [End Visit](#)  
 No encounters yet

**Add Test Order**

Encounter\*

Test Type\*

Lab Reference Number\*

Care Setting  OutPatient  InPatient

Instructions

[Save Test Order](#) [Cancel](#)

Above screenshot represents the form to create Test Orders.

- There is an encounter linked with each test order therefore, the order date (date\_activated) is set to the encounter date.
- Test Type field refers to the kind of test for which order is being requested.
- Lab Reference Number is auto generated timestamp which basically serves as Lab ID (it can be edited later and can be replaced with exact Lab ID, if available).
- Whereas care setting denotes the type of patient indicating whether the patient is hospitalised (In-Patient) or simply an Out-Patient.
- Instructions is a self-explanatory field.

After the test order is successfully created, the *List Test Order* is updated in *Lab Tests* tab as it can be seen below.

The screenshot shows the patient profile for Harry James Potter (Patient ID: THYSQ-0). The 'Lab Tests' tab is active, displaying a table of test orders. The table has columns for Test Type, Lab Reference Number, View, Edit, Manage Test Sample, Test Result, and Result Date. A single entry is shown: 'Fasting Blood Sugar Test' with Lab Reference Number '2019-01-08 10:42:50.019'. The 'View', 'Edit', 'Manage Test Sample', and 'Test Result' buttons are highlighted with yellow boxes and numbered 1 through 4 respectively. Below the table, there are 'Previous' and 'Next' navigation buttons.

The list of Test Order contains following options:

1. *View* button opens up a modal dialog which contains all the details related to the test order from order to results phase. It has three sections Test Order Detail, Test Samples Detail, Test Result Detail. Initially, these sections are empty, but as soon the as the data is saved, it is displayed in the relevant section as seen in the screenshot below.

The screenshot shows the 'View Test Order' modal dialog. It is divided into three sections: Test Order Detail, Test Samples Detail, and Test Result Detail.

**Test Order Detail:**

- Test Order ID: 339
- Test Group: BIOCHEMISTRY
- Test Type: Fasting Blood Sugar Test
- Encounter Type: Comorbidities-Mental Health Screening
- Lab Reference Number: 2019-01-08 10:42:50.019
- Requires Specimen: true
- Created By: owais.hussain
- Changed By: null
- Date Created: 2019-01-08 15:43:25.0
- UIID: 8d56d923-1279-493b-a932-edfa8059062

**Test Samples Detail:**

Test Order	Specimen Type	Specimen Site	Status
339	WHOLE BLOOD SAMPLE	WHOLE BLOOD	PROCESSED

**Test Result Detail:**

Group Name	Question	Value
	Fasting Blood Sugar Result Value	140
	Fasting Blood Sugar Result Unit	mg/dL
	Other Test Unit	none

2. *Edit* button opens up the *Add Test Order* page in an edit mode therefore, already saved information related to Lab Test Order can be changed. When Add Test Order page is opened in Edit mode, it also displays an option to void Test Order.

Care Setting  OutPatient  InPatient

Instructions

**Void Test Order**

Reason\*

3. *Manage Test Sample* button redirects to the page that contains Sample information for each test order. (Not all test orders require sample, this is discussed in configuring metadata section under Lab Test Types heading). There is a list of samples available on this page which contain a field named *Status*. *Status* indicates the current state of the sample. Initially when *Add Test Sample* form is filled, the newly collected sample has a status as *COLLECTED*. This sample can be *REJECTED* for any reason like it may have expired or contaminated but if it is ready for the test to be conducted then its status is changed to *ACCEPTED*. After the Test Results are entered, its status is changed to final state as *PROCESSED*.

**Harry James Potter** Patient ID: **THY5Q-0**

39 yrs (31-Jul-1980) Test Patient: true Primary Phone Number: 03452345345 Mother Name: Lily Potter National ID: 42101-1234567-8 External ID: 2017/04210024

BMI: 26.4 (Weight: 62.0 kg, Height: 153.0 cm) registration\_date: Regimen:

Active Visit: Facility Visit from 31/07/2018

No encounters yet

[Back To Patient Dashboard](#) [+ Add Test Sample](#)

**List Test Sample**

Show 10 entries Search:

Sample ID	Specimen Type	Specimen Site	Sample Identifier	Collected On	Status
No data available in table					

Showing 0 to 0 of 0 entries

4. *Test Result* button redirects to *Add Test Result* page. After the results are entered, the status of the sample is changed to *PROCESSED*, and in case of voiding the result, the sample status changes back to *COLLECTED* again respectively. Once the results are entered, result page opens up in edit mode and also displays an option to void test result. The below screenshot displays the *Add Test Result* page.

**Add Test Result**

Fasting Blood Sugar Result Value  Decimal value with max length 5

Fasting Blood Sugar Result Unit

Other Test Unit  Maximum Length can be 10

Attachment  blood-sugar-chart.jpg

Following form can be used for generating multiple Test Order requests. It displays all Test Types in their respective Test Groups which are initially closed sections. On clicking the plus icon, the section opens up and on selecting the corresponding checkbox, Lab Reference number is filled with auto generated timestamp.



**Add Test Request**

Encounter\*

**BACTERIOLOGY**

**BIOCHEMISTRY**

**CARDIOLOGY**

**HEMATOLOGY**

Test Type	Lab Reference	Instructions
<input type="checkbox"/> CBC	<input type="text"/>	<input type="text"/>
<input type="checkbox"/> ESR	<input type="text"/>	<input type="text"/>
<input type="checkbox"/> Histopathology or FNAC	<input type="text"/>	<input type="text"/>

**OPHTHALMOLOGY**

Test Type	Lab Reference	Instructions
<input type="checkbox"/> Eye Examination	<input type="text"/>	<input type="text"/>
<input type="checkbox"/> Visual Screening	<input type="text"/>	<input type="text"/>

**RADIOLOGY**

**SEROLOGY**

**SONOLOGY**

## Sample Management

On *Manage Lab Test Sample* page, there is a link to *Add Test Sample* page. It has four required fields Specimen Type, Specimen Site, Sample Identifier and Collection Date. Like Lab Reference Number, sample identifier is an auto-generated time stamp which can be edited and replaced with the actual Sample ID, if available.

**Add Test Sample**

Specimen Type\*

Specimen Site\*

Quantity

Unit

Sample Identifier\*

Collection Date\*

After the test sample is successfully added, the list on the Manage Test Sample page is updated and the newly entered sample is set to **COLLECTED** status. Sample status is an enum with four possibilities i.e. **COLLECTED**, **ACCEPTED**, **REJECTED**, **PROCESSED**. Please note that there is an option to reject sample as well in case if sample is contaminated or expired. **REJECTED** samples are not acceptable for conducting tests, therefore in case of a rejected sample, a new sample has to be submitted. Results can be entered only after sample status is changed to **ACCEPTED**, and after successful submission of test results. sample status changes to **PROCESSED** status.

**Success!** Lab Test Sample with Uuid :ca3c03b5-9b2e-4f2e-876b-896ca3b8bf4a is saved!

**List Test Sample**

Show  entries Search:

Sample ID	Specimen Type	Specimen Site	Sample Identifier	Collected On	Status		
<input checked="" type="checkbox"/> 161	LYMPH NODE	PLEURAL EFFUSION	2019-01-11 06:00:35.287	2019-00-11	COLLECTED	<input type="button" value="Reject"/>	<input type="button" value="Accept"/>

Showing 1 to 1 of 1 entries



### Voiding Data

- If a Lab Test Type is deleted, its referred data like Lab Test Orders and Attribute Types are linked to UNKNOWN Test Type.
- If a Lab Test Type is deleted (purged), its referred data like Lab Test Orders are also deleted (purged). It can be done by calling method `deleteLabTestType(LabTestType labTestType, boolean cascade)` and passing `cascade` as `TRUE`.
- If a Lab Test Attribute Type is deleted (purged), all attributes that were saved against this Attribute Type are also purged.
- If a Lab Test is voided, its subsequent linked data like Test Samples and Test Results (attributes) are also voided.
- If a Lab Result is voided completely (all attributes), then the sample linked to this result is changed back from PROCESSED to COLLECTED status again.

## Downloads

<http://modules.openmrs.org/...>

## Source Code

<https://github.com/openmrs/openmrs-module-commonlabtest>

## About

This module was developed by [Unknown User \(owais.hussain\)](#) [Unknown User \(tahira\)](#) [Unknown User \(ahmed14\)](#) and Shujaat Ali from [Interactive Health Solutions](#).