Ministry of Health

Department of Hospital Services

Bureau of Medical Laboratory Services

User Guide for Cambodia Laboratory Information System

CamLIS

Cambodia Laboratory Information System

Sept 2017

Preface

In the previous decade, new modern technology has been notably developed. Likewise, the emerging and spread of pandemic diseases around the world highlight the importance of laboratory testing and pathogens identification to support disease surveillance and diagnosis, with the aim of serving public health needs. This includes assisting clinicians in diagnosis and research on the causes of illness and possible exposure in order to setup control measures to prevent and provide timely patient treatment. The establishment of laboratory information systems allows for standardization of laboratory results in both general and microbiology testing. Furthermore, the laboratory information system will be linked to the Patient Management Registration System (PMRS), which is the data center at Ministry of Health, and will be used to support national health information management.

The Ministry of Health has developed this laboratory information system, called "CamLIS (Cambodia Laboratory Information System)", with the support of the World Health Organization (WHO). The laboratory information system, CamLIS, will help with data management including patient demographics, laboratory analysis results, antimicrobial resistance…etc. It will also assist epidemiologists with data management and analysis in order to set up control measures and response to disease outbreaks, prevention policies for epidemics and response plans for associated authorities.

The Ministry of Health would like to show gratitude for the financial support, technical support, and the invaluable participation to develop "CamLIS" from the Sub-technical working group for blood safety and Medical laboratory services, and microbiology laboratory network of Hospital Services Department, World Health Organization, URC, as well as Foundation Merieux, and DMDP who have supported the rolling out of this system.

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14. Ms. Joanne Letchford	Cambodia Country director. Diagnostic Microbiology Development Program

15. University Research Co., LLC (URC), Other laboratory experts, SubTWG for Blood Safety and laboratory services

Contents

1) Introduction

1.1 Why was this database developed?

The laboratory is essential for the experimental analysis of specific patient samples, enabling doctors to diagnose and provide patient follow-up, as well as proper and timely treatment. This information will help to mitigate the risk of diseases that affect public health. As such, the efficient management, storage, and analysis of all laboratory information is essential. Previously, all such information was stored by each laboratory in an incomplete and non-standardized manner. These issues made it difficult for doctors and health professionals to find the data needed for decision making.

Therefore, in early 2012, with the collaboration and technical assistance of the World Health Organization, the Ministry of Health developed a laboratory information management system called CamLIS (Cambodia Laboratory Information System). This database allows all laboratory personnel to enter their laboratory data and perform analysis as required. Similarly, data from each laboratory is sent to a database center via internet connection, allowing other key personnel in the Ministry of Health to analyze and monitor data. CamLIS has been linked to a patient registration database in the Patient Management Registration System (PMRS) since 2015, with technical assistance from University Research Co. (URC).

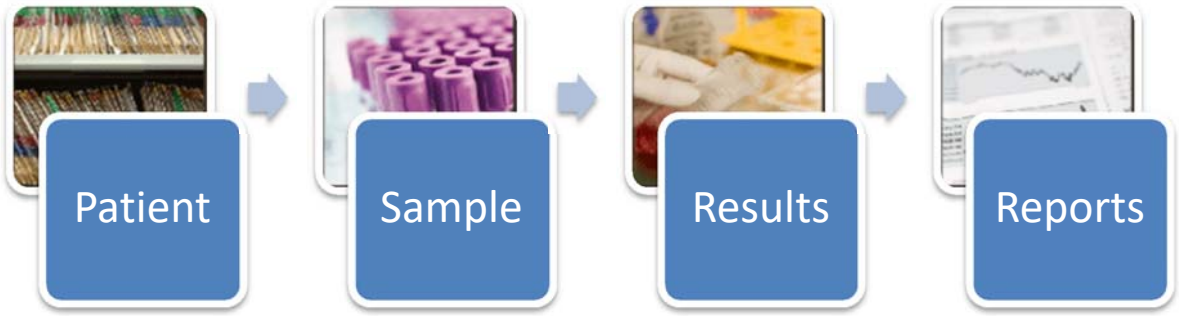
1.2 How to use the manual

The laboratory information system manual describes the laboratory information management system, highlighting the processes and components of the entire electronic laboratory information system used in the Kingdom of Cambodia. The following functions and activities can be performed by the whole system:

- Registration: Search or Enter patient information
- Sample entry: Search or Edit information related to patient samples
- Result entry: Enter and Validate laboratory results
- Report generation: individual patient report and aggregated report
- Extract data based on conditions and filters
- Other system management related to the system parameters, possible test results, antibiotics, and users.

2) How to use the web based system

This section aims to introduce laboratory personnel to CamLIS in the management of laboratory information by starting with the following:



Hospitals with PMRS: The patient record is retrieved from the PMRS system that has been inserted from the outpatient site using the patient's code.

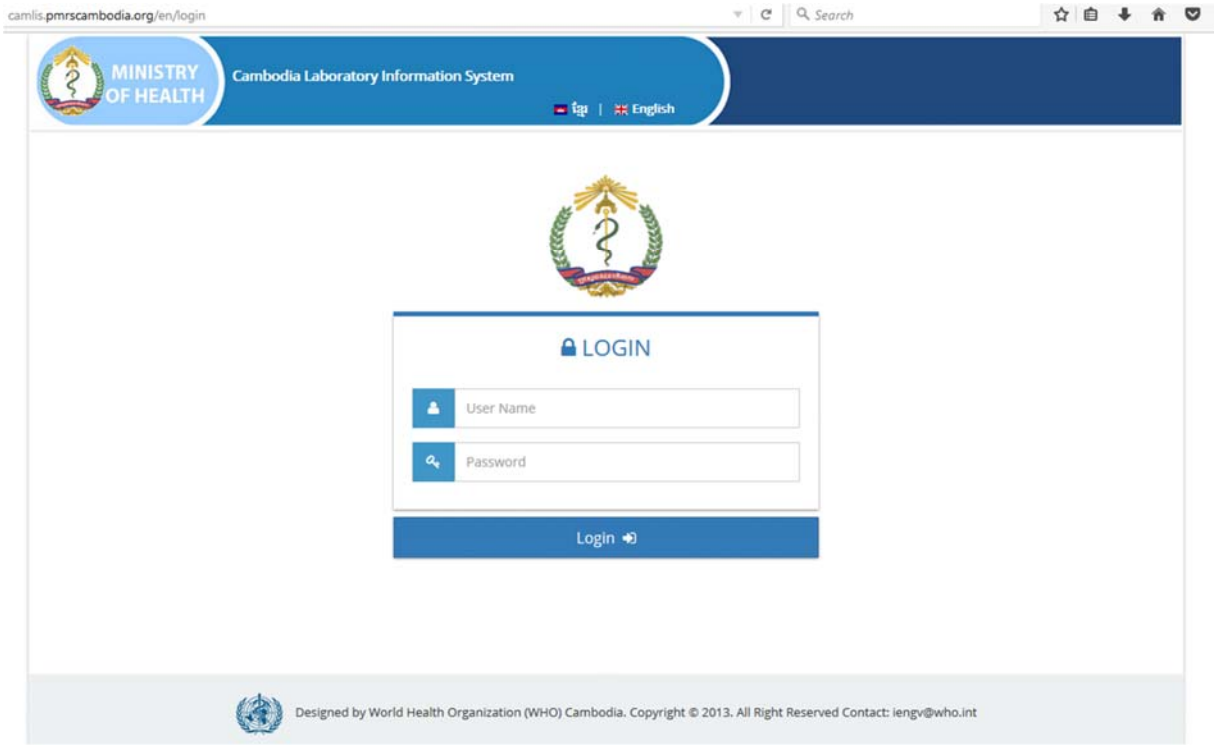
Hospitals without PMRS: Laboratory personnel must enter the patient's record manually.

The next step involves entering the **sample-related information** and selecting the type of test that the physician or doctor requested for analysis. After analyzing the results, the laboratory personnel shall incorporate those **results** into the CamLIS system and report those results to the physician. In this case, it is crucial that the results are verified and validated by the laboratory personnel to avoid any human or machine-prone error.

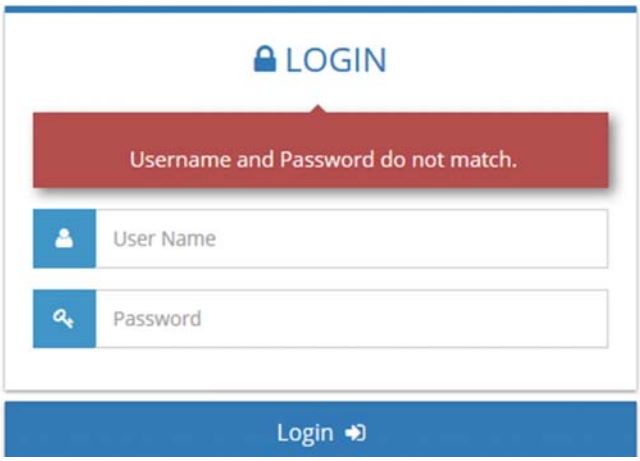
Finally, the data must be provided within a format that can ease the decision making process. The report section will provide various formats for CamLIS users.

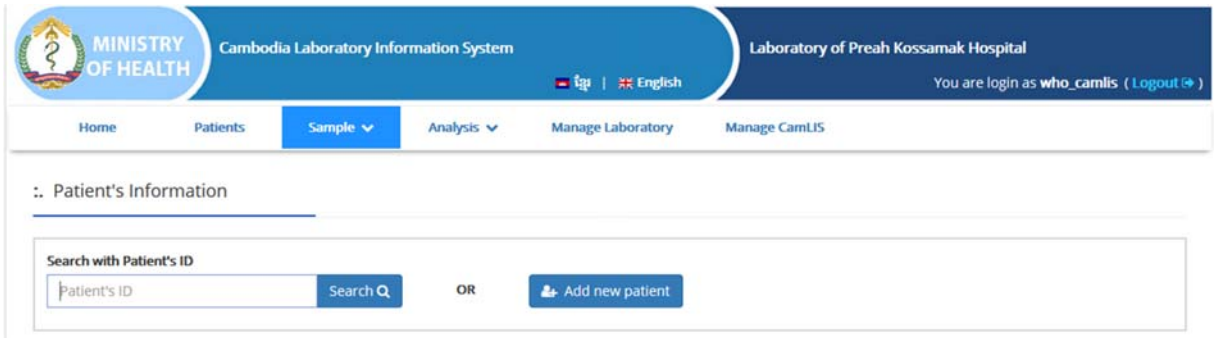
2.1 Log in to system

To access the CamLIS web based database, an internet connection and a browser software, such as Firefox or Chrome, are required. Next, the web address **www.camlis.pmrscambodia.org** should be entered to open the CamLIS web based database. If the address has been entered correctly, it should display the following interface for entering the username and password into the application.



The username and password that was created and given by the administrator must be entered, then click "login". If username and password were entered incorrectly, a "Username or password do not match." display will appear, after which the procedure must be repeated until correct username and password have been entered (picture below)



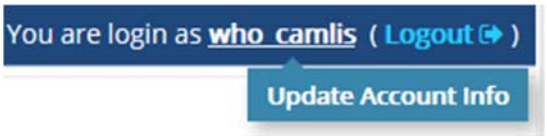


2.2 Changing user account or password (for laboratory manager)

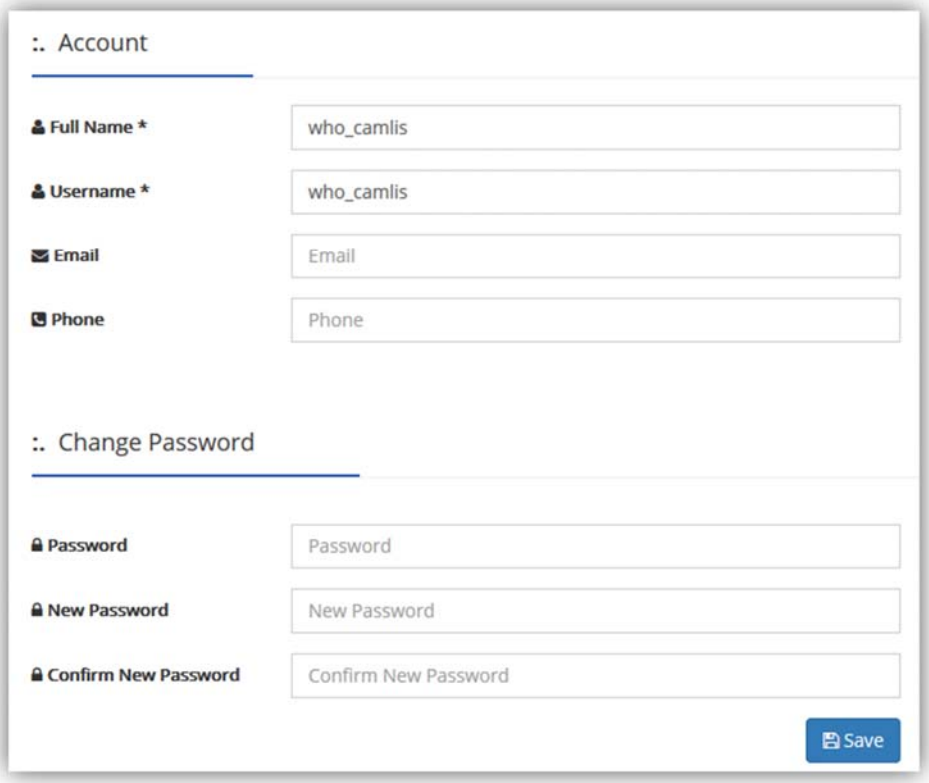
The username and password have been created and assigned by the laboratory managers of each laboratory. The user account can be manually changed by the user or by laboratory manager.

To change the user account manually

1- Click on the username at the top-right corner of the screen



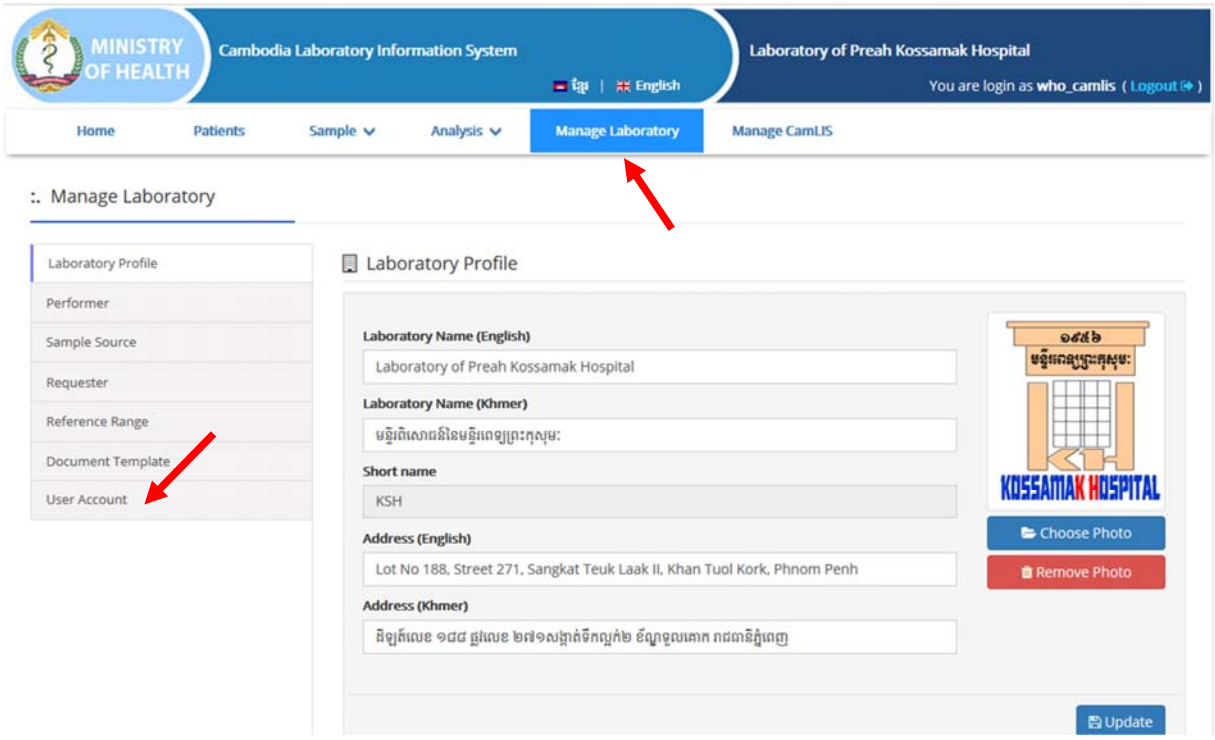
2- A new screen will appear, allowing the user to make edits to the personal information, as well as the password (user must remember the old password).



- Enter the old password, then enter the new password twice for verification or editing of any information as needed, then click save.

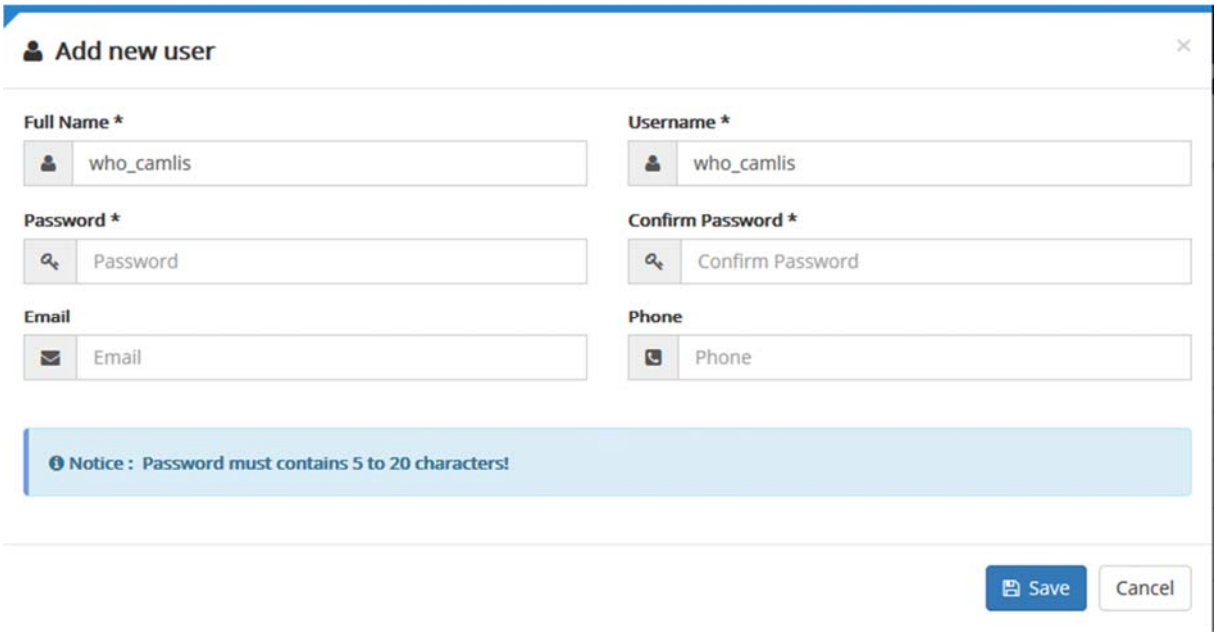
3- To change the user account and password via laboratory manager (does not require old password):

- Click on the menu "**Manage Laboratory** then select "**User Account**" on the left.



- A new screen will display all the existing users of the laboratory.
- Click on 

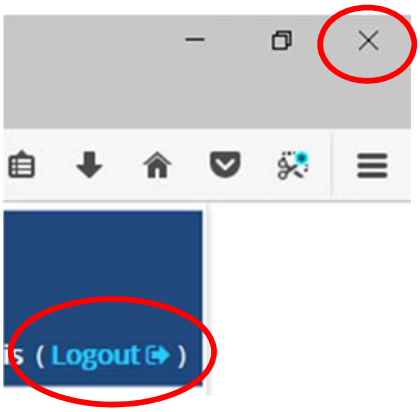
, is in the same row as the username, in order to change the password.



- Enter the new password into "**Password**" and "**Confirm password**" fields or other information field, then click save.

2.3 Log out from system

Usually, exiting an application is simple. Likewise, for this application, all that is needed is to click on "**logout**". Any existing work will be closed, allowing other users to login. To close the internet browser, click on the cross (X) at the top-right corner.



Note:

- Creating new user accounts requires an administrator or lab manager to create a username and password for them.
- Avoid using others' usernames and passwords to access the system
- Be cautious of upper and lower-case letters when creating new passwords or entering the passwords. i.e. A is different from a. Letter cases does not affect the usernames.

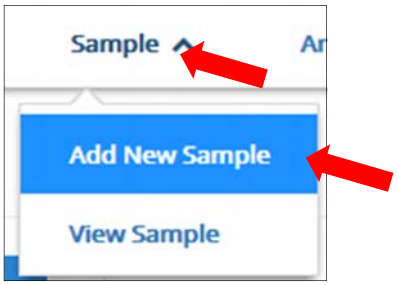
3) Patient Information

After having successfully accessed the application, users are able to proceed to the next steps within the database. This section will provide information on how to enter new patient data and searching patient data from the PMRS system before linking those patients to the requested samples. At the same time, this section will show how to input the necessary patient data before saving it into the system.

3.1 Enter patient data

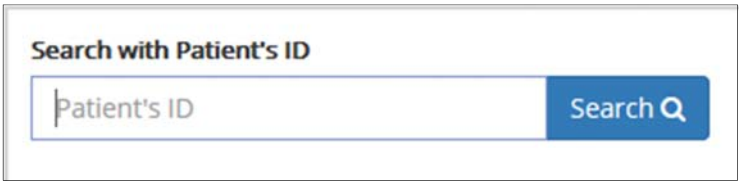
To enter patient data, you must do as the following:

1- Click on menu "Sample" then select "Add new sample"

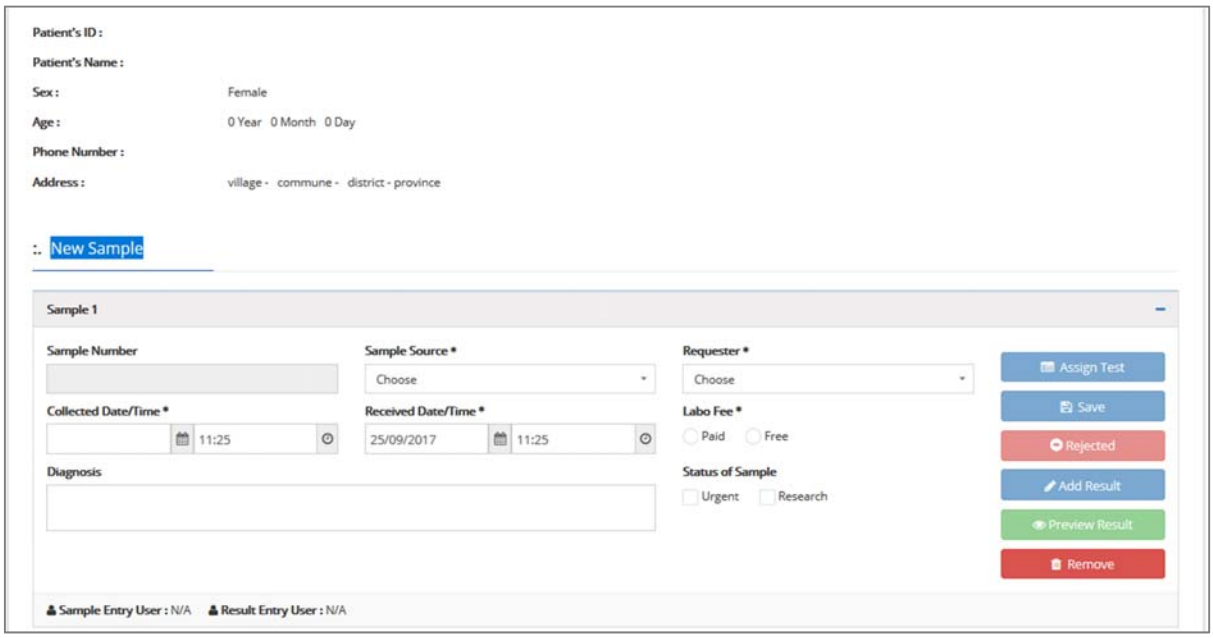


➢ **For CamLIS linked with PMRS**

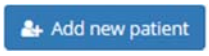
- Begin by entering the patient ID into the patient ID box then select "Search"

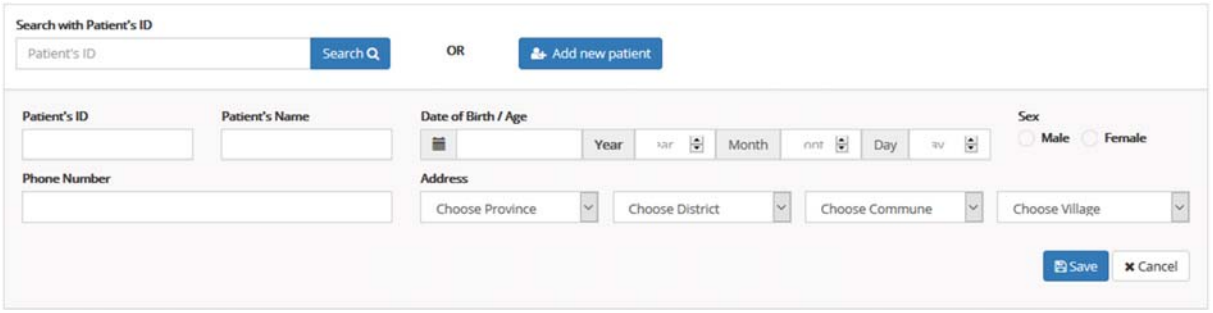


- If the system cannot find the entered patient ID, it will display "No result found"
- If the system finds the entered patient ID, it will display the patient data and will allow the laboratory personnel to begin the sample data entry (see following picture)



- **For CamLIS not linked with PMRS**

  - Click on  to access the web page for patient data entry:



+ **Patient's name**: Name or initials written on the request form

+ **Sex**: Sex of patient (Male/Female)

+ **Date of birth**: Patient date of birth. No need to fill in if data is unavailable. Patient age will be automatically calculated once entered.

+ **Age**: Length of time from patient birth to date of hospital admission. Once entered, patient date of birth will be automatically calculated.

+ **Telephone number**: Patient contact number, if available.

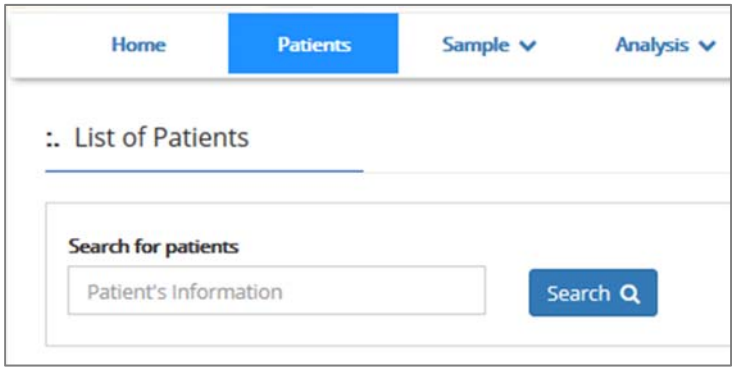
+ **Address**: Includes Province/City, District, Commune, Village

- Click on "**Save**" to verify and save the data.
- Click on "**Cancel**" to exit

3.2 Find patient data

To find patient data, you must do as the following:

1- Click on "**Patient**"

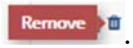


2- Enter the patient ID or Patient Name into the patient's information field and click "**Search**"

3- If the system cannot find the entered patient ID, it will display "No matching records found"

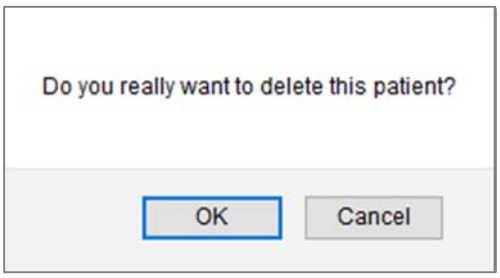
4- If the system finds the entered patient ID, it will display the patient's data as in the following picture.

3.3 Delete patient data

To delete the patient data, select which patient data to delete by clicking 

.

The following message will appear to confirm deletion.



To delete, click on “OK” or click on “Cancel” if for no deletions to occur.

Note:

- All dates must follow the day-month-year format, or select the date via the provided calendar.
- The system will automatically assign a new patient ID if no input from users.
- You must have user right to delete patients.
- Deleted data can be restored by the administrator.

4) Sample Information

This section will explain how to enter new patient samples, edit previous samples, and how to assign requested tests by the physicians into CamLIS.

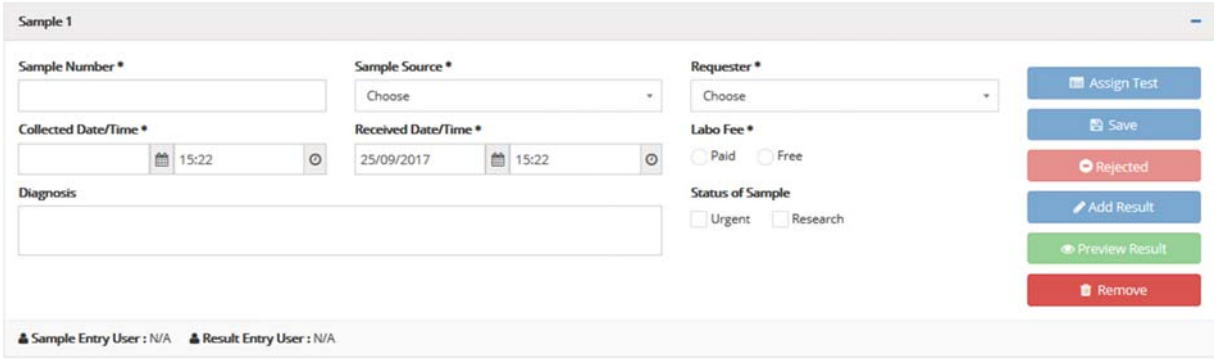
At the laboratory, this activity is usually done in a consultation room or at sample collection room, and plays an important role in the process of the laboratory information system. If this activity is not done correctly, laboratory staff may not be able to enter the results for the specimen. As a consequence, the doctor will not possess sufficient information for treatment.

4.1 Add new sample

This allows users to select patients from PMRS or enter new patient data (see 3.1) that has yet to be tested, in order to include additional information and samples.

To enter new sample data for any patient: Follow 3.1 in order to enter new patient data.

1- Enter sample information like the following:



+ **Sample number**: readily defined by the administrator in the format (xxx-ddmmyyyy)
+ **Sample source**: name of ward, sector, or institution that sent the specimen.
+ **Requester**: name of doctor or responsible for requesting tests.
+ **Collection date/time**: date and time of sample collection. **Received date/time**: date and time of sample arrival to laboratory.
+ **Paid**: Confirmation that analysis was paid by patient

+ **Free**: Comfirmation that no payment was required by patient**.**
+ **Urgent**: Samples requiring immediate results.
+ **Research**: Samples sent for researchpurposes.
+ **Diagnosis**: diagnosis, ymptoms and clinical history of the patient.

2- List of usable bottons

For showing test table for selection.

For saving sample information and selected tests

For rejecting any sample or test

For entering test results

For viewing entered test results

For deleting entire sample and test

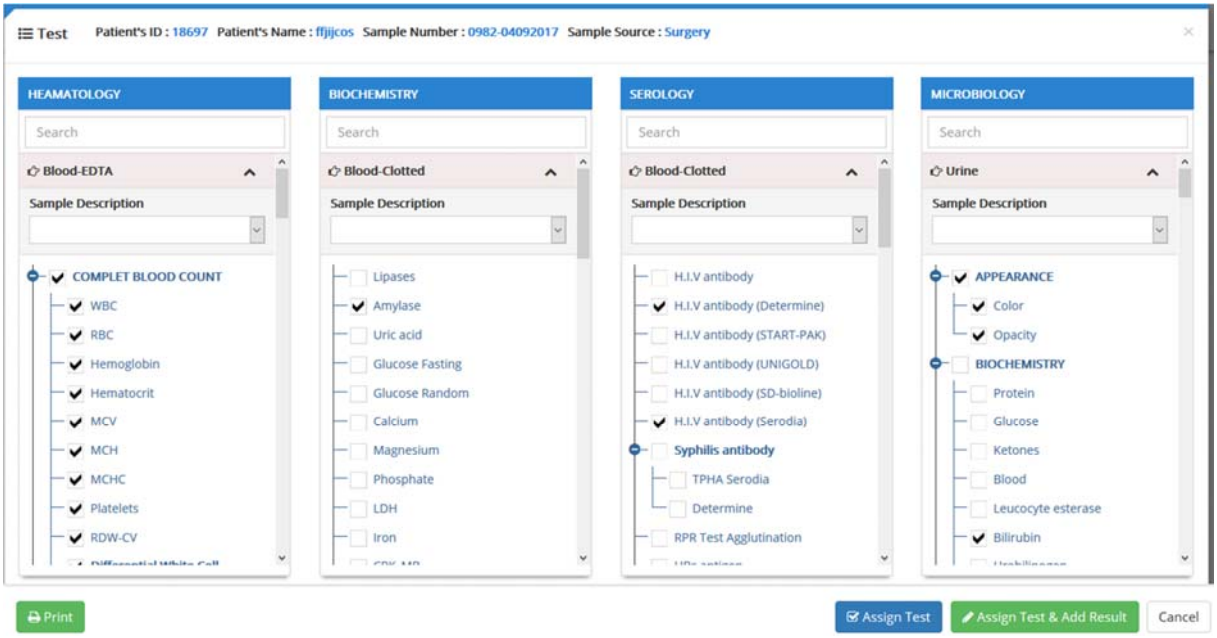
3- After a sample has been entered, the application will display a new button below for entering another sample.

4.2 Assign test

After entering all the sample information, any requested tests for analysis must be assigned:

1- Click on 

on thesample for which the test is to be assigned. The test table, organized by unit (hematology, etc) as below, will appear for test selection:



2- Select the test to be performed, then click on "**Assign Test**" to save

3- If results for the selected test are to be entered immediately, click on "**Assign test & Add result**", andthe table for entering results will appear.

4- To print the selected test, click on "**Print**"

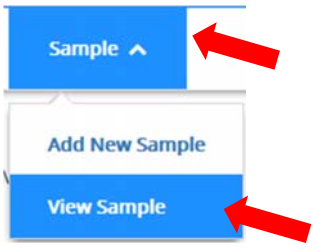
5- To exit without saving, click "**Cancel**"

4.3 Search and Update sample

This section will allow users to add new samples, or make edits to existing samples, and tests for patients who had already been tested.

For this:

1- Click on "**Sample**" then click "**View Sample**"



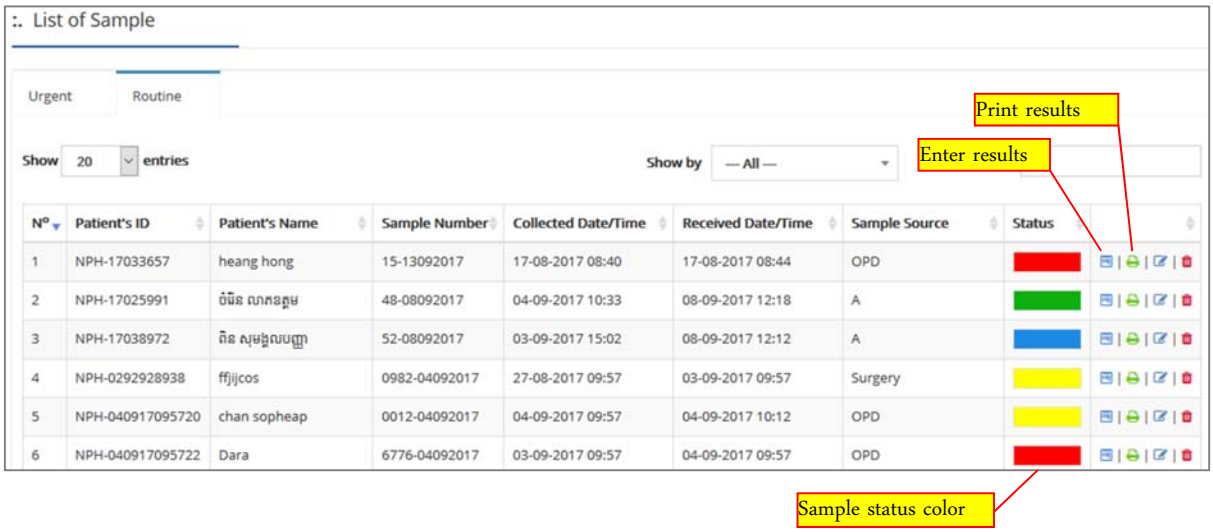
2- Another screen will appear showing the table of patients that had previously been entered

3- This table is divided into two:

   a- Table for urgent patient tests

b- Table for routine patient tests

-



Colors represent sample condition:

- Pending
- In progress
- Complete
- Printed

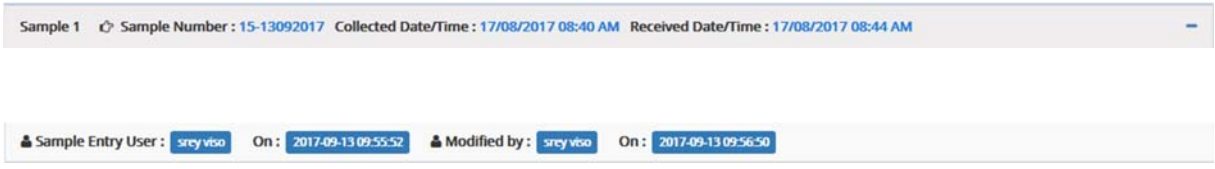
4- Users can open individual pages to find specific patients:

+ **Previous**: for viewing the first registered patient
+ **Page number [1]**: for viewing each page
+ **Next**: for viewing the last registered patient
+ Users may also enter filters into "**Search**" box to find specific patients such as: **Patient's ID**, **Patient's name**, **Sample ID**, **etc.**

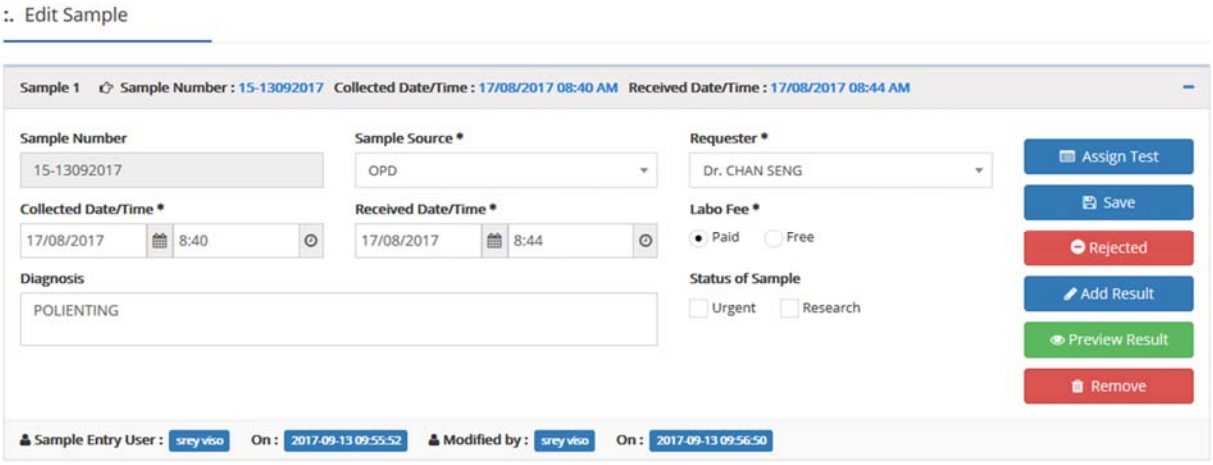
5- After finding the patient, click on Edit

6- Patient sample information will appear (see 4.1),which may then be edited if necessary, the same goes for the test selection table.

It will also show the following information:



7- After making edits, clicksave.



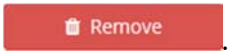
8- If entering more samples is required for each patient, click on  then enter the sample information into the data fields (see 4.1).

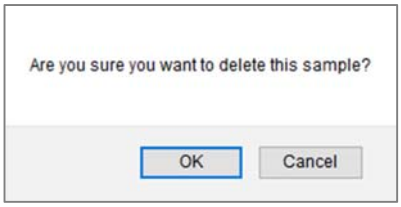
4.4 Delete sample

Deletion of samples, as well as other data, requires extreme caution and attention as deleted data cannot be restored. If a sample is deleted, all tests performed on it will also be deleted.

To delete samples,:

1- Follow steps 1 to 4 in section 4.1

2- Once the sample that is to be deleted is found, select  . A confirmation message will display as below:

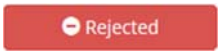


3- Click Ok for deleting sample, or cancel to return (no deletion will occur).

4.5 Reject sample

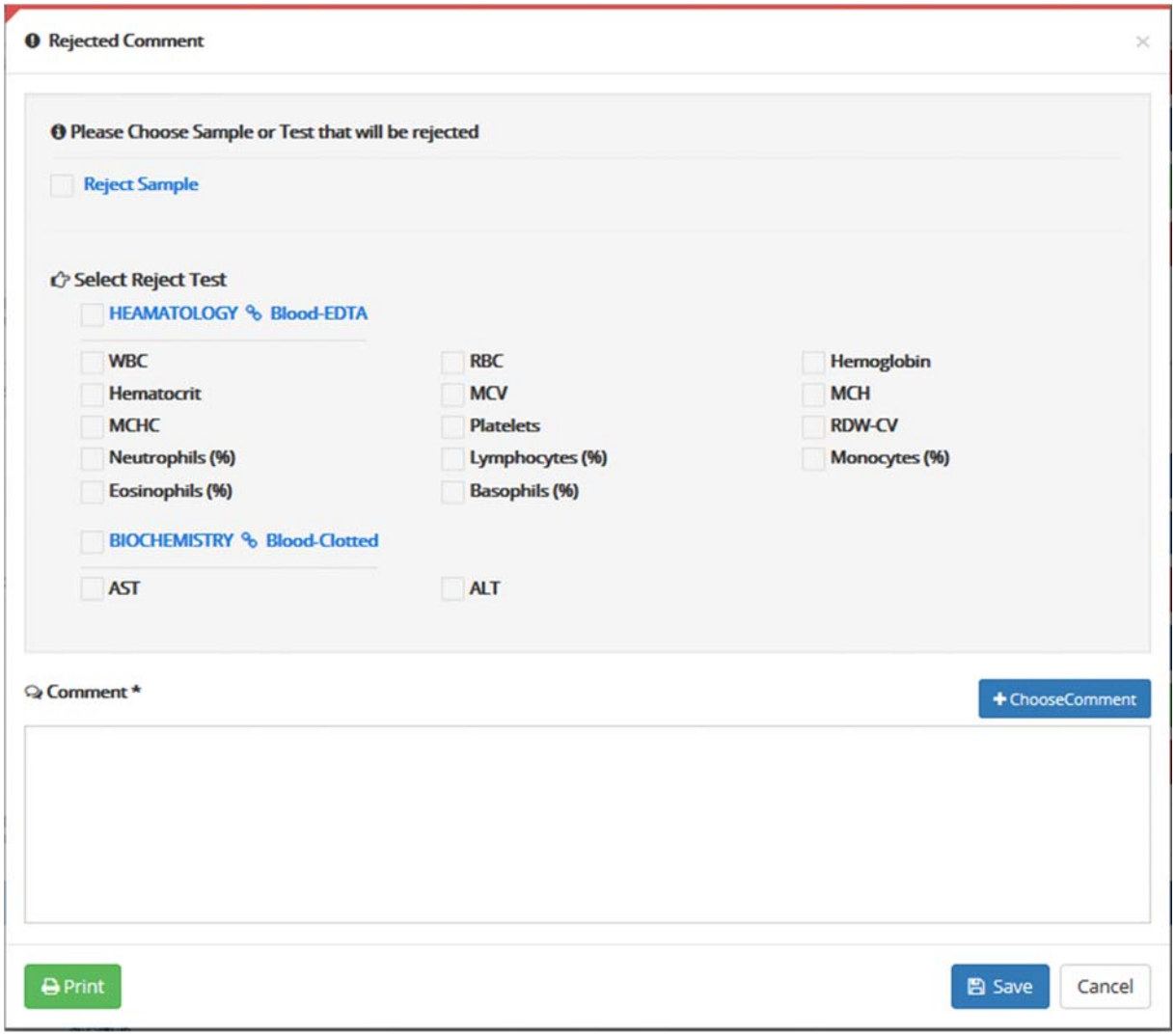
Staff working at sample receiption may refuse testing of samples requested by the doctor, if a sample is deemed inappropriate.

1- Follow steps 1 to 4 in section 4.1

2- Click  to open the sample rejection page.

3- Select "**Reject Sample**" to refuse sample and all associated tests, or click on a specific test to select which test to reject. Enter reasons for rejection into the "**Comment**" box or click on "**Choose comment**" to choose pre-defined reasons.

4- Select "**Save**".



5- For printing rejected tests, select "**Print**".

Note :

- Rejection can only be done if the user has already selected the tests requested by the doctor.

5) Laboratory Results

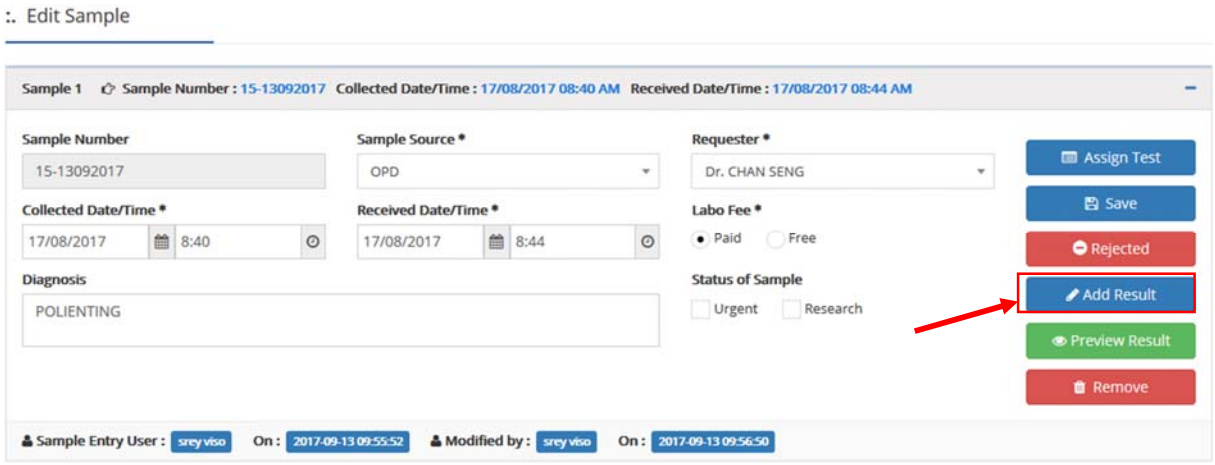
When patient and sample information have been entered into the system, the test results can then be entered. This is the area where laboratory technician has an importance role for the functioning of the system. The laboratory technician is responsible for entering all information related to the laboratory results for each patient. The laboratory manager may also verify the results before submitting them to a doctor or a patient.

5.1 Enter laboratory results

This section allows users to select new patients or patients sample number to enter results pertaining to sample and tests .

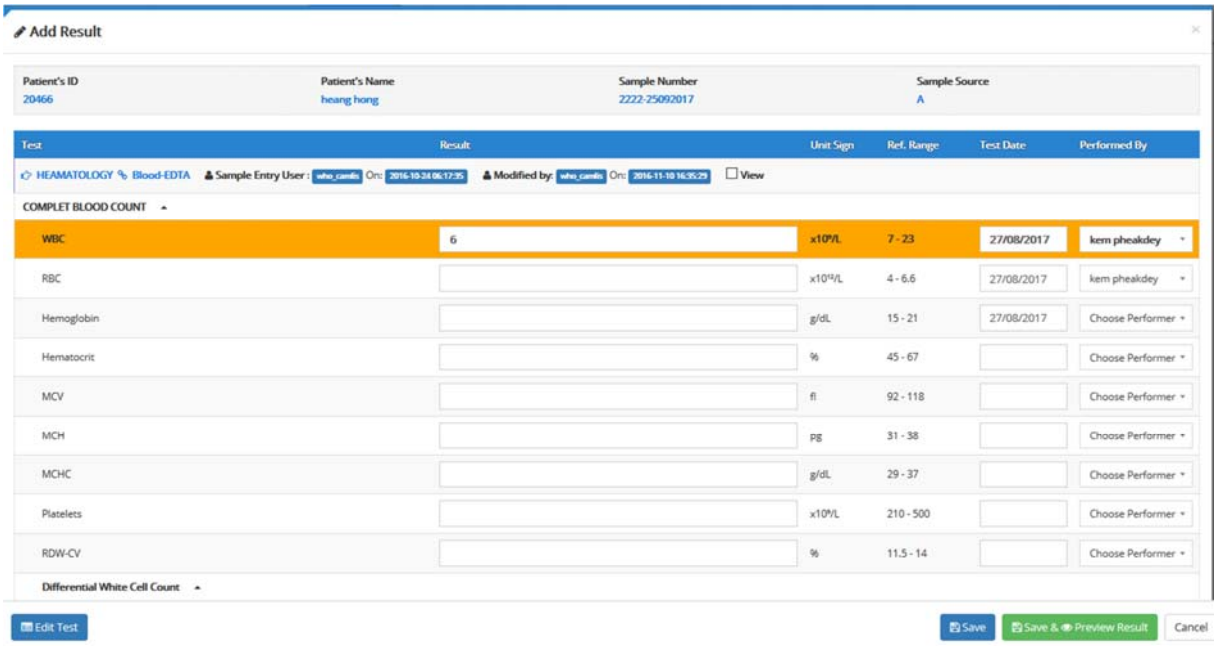
To enter test results: Follow steps 1 to 4 in section 4.1

1- Click on "**Add result**" (see picture below)



2- A new screen will appear which will allow the user to enter results based on the requested tests.

3- Enter results based on the test name's order to avoid data entry error. Unit and reference ranges for each test will also be visible to the data entry officer. If a patient has many tests, click on the scroll bar at the right side of the page to scroll the page up or down.



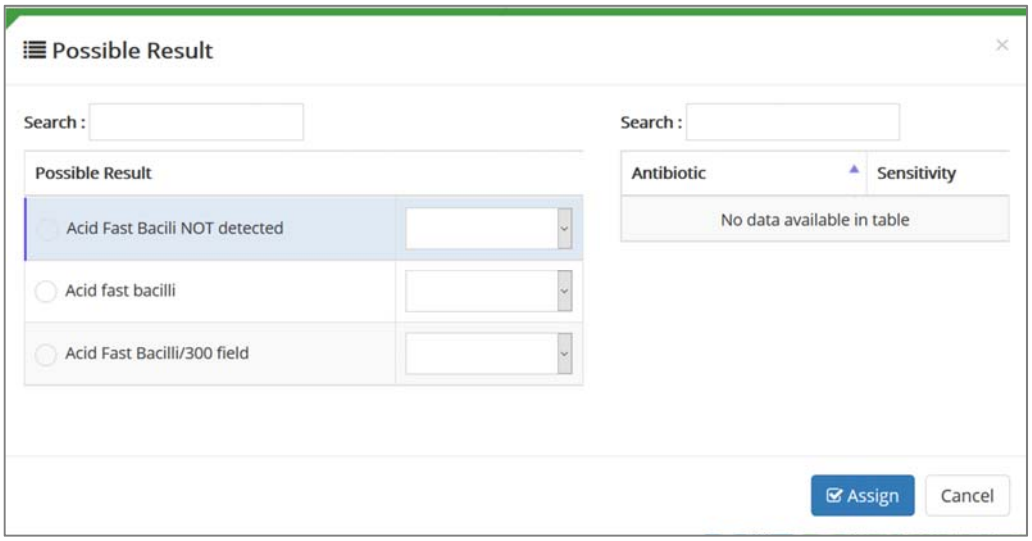
4- Information required:

- **Result**: Test results collected from the analyzer machine including numeric or text format.
  - ➢ If numeric results (usually with units) are entered outside the reference ranges, the entire row will be highlighted in orange, indicating entry of anomalous values..

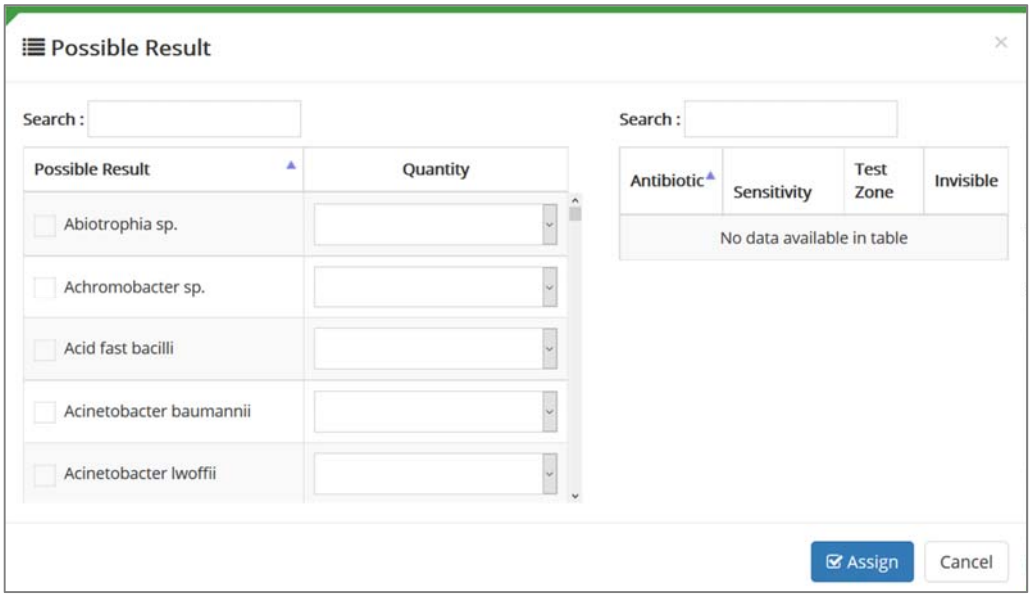
  - ➢ For results having units as "Single" or "Multiple", the cursor should be moved in or use the mouse click in the result field. After that, select any results that already available in the list.

Another screen will appear, allowing the user to select possible results in the list.

* Single: only one result can be selected



* Multiple: more than one result can be selected



After choosing the possible results, click on "Assign" to confirm.

- For the result boxes with no units, any text can be filled in (Free Text).

+ **Test Date:** date of sample testing. needs to be changed according to the actual test date.

+ **Performed by:** name of laboratory technician who performed testing on each sample. All laboratory technicians' names should have already be in the system, previously registered by the laboratory manager. If there are staff names missing the laboratory manager should be informed so they can be added in the system..

+ **Diagnosis:** Diagnosis or signs and symptoms entered by the physician on the request form, which may then be entered or selected from the list by the laboratory technician.

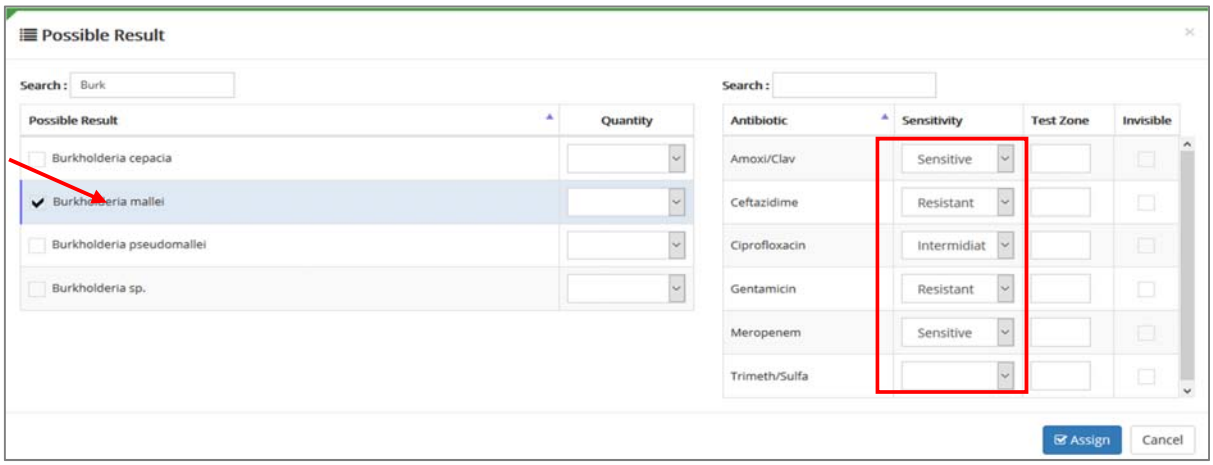
5- Click on "**Save**" to record all the information entered.

6- Alternatively click on the button "**Save and Preview Result**" to record and preview all the information entered. To preview for specific results, click on the check box ☑ View located next to each department (you tick more than one department).

5.2 Enter microbiology results

Entering microbiology results is similar to what has been described for other test results in the system. The difference is that Microbiology can have more than one result, each one in turn may have many antibiotic susceptibility testing (AST) results.

1. Follow section 5.1 from step 1 to 6.
2. The majority of microbiology results have the unit as "Multiple". Click on the result field to display all possible result selectionsChoose the correct result, according to what you have identified. If another AST is required, another anbitibiotic table will appear for susceptibility specification, i.e., "Sensitive, Intermediate, Resistance". The test zone may also be entered, and invisible may be selected if no AST is to be reported to the physician.



Click on the button "**Assign**once all selections have been done and follow the same activity in 5.2 from step 7 to 8 above for other tasks.

5.3 Print results

In general users can easily find patient's results by using patient ID, patient name and sample number (see section 4.3).

1. Follow section 4.3 from step 1 to 6 to find the patient sample that already had results.
2. Click on 

to preview patient results.
3. Verify and valide the results and click on 

at the top of the screen to print.

Note :

- Records entered will be available for the individual report
- Do not use Ctrl + P to print patient results

6) Analysis

This laboratory information system was developed for users to analyze, manage and share information related to laboratory activities in order to improve public health. The purpose of this web based system is not only for printing results or storing data electronically, but also to support the clinical treatment process, the laboratories andhealth related programs, to aid in the upstream decision making process.

In this part, the user will learn how to analyse data by using report templates to support decision maker after all information were collected and entered in the system.

6.1 Individual report

This report displays all results of each patient including testing history.

To make this report, follow the steps below:

1. Click on the menu "**Analysis**" and click on "**Report Generation**"
2. A new screen will display for the users to select type of reports to generate

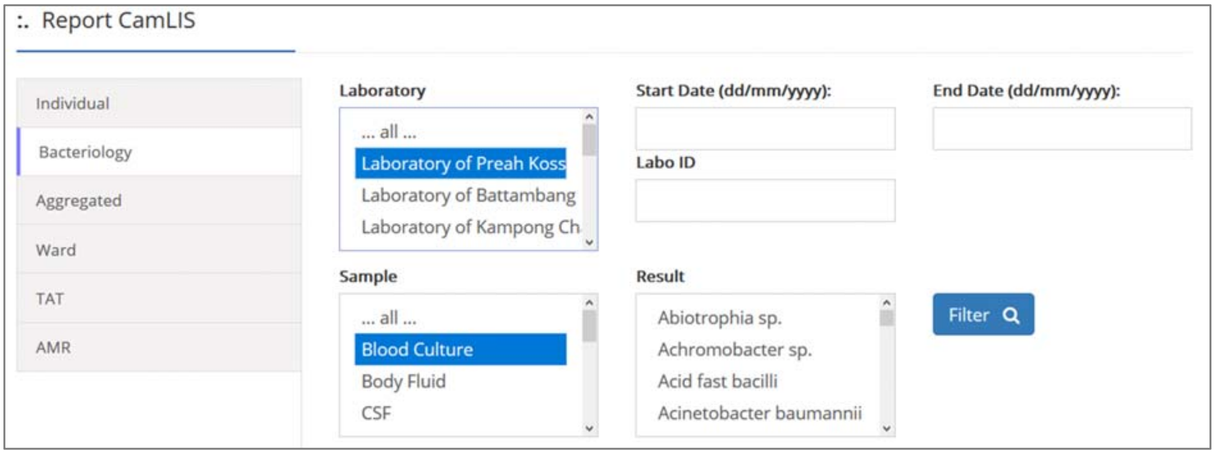
3. Select on the report type "**Individual Report**" and input patient ID and Patient name and Sample Number to make the report.
4. Once finished, click on "**Filter**" to open patient results available in the system and print as needed.

6.2 Microbiology report

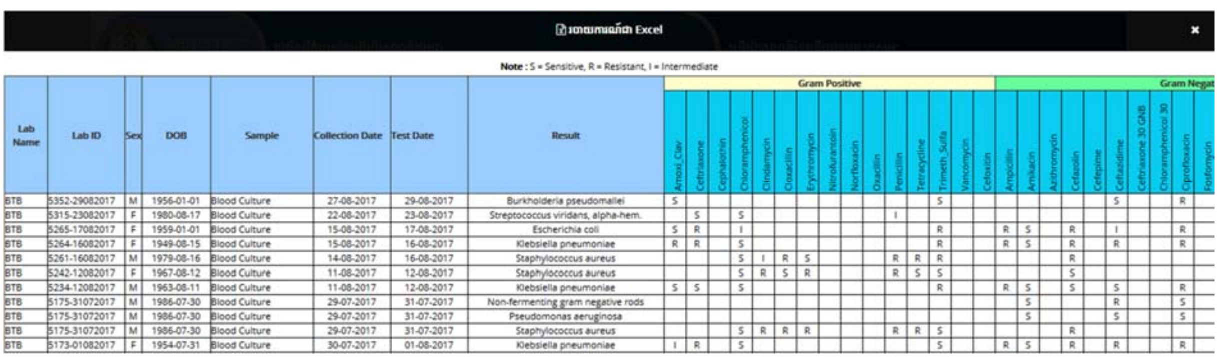
This report shows a list of patient reults that were tested positive in the microbiology department.

To make this report, do the following:

1. Click on the menu "**Analysis**" and click on "**Report Generation**"
2. A new screen will display for the users to select type of reports to generate



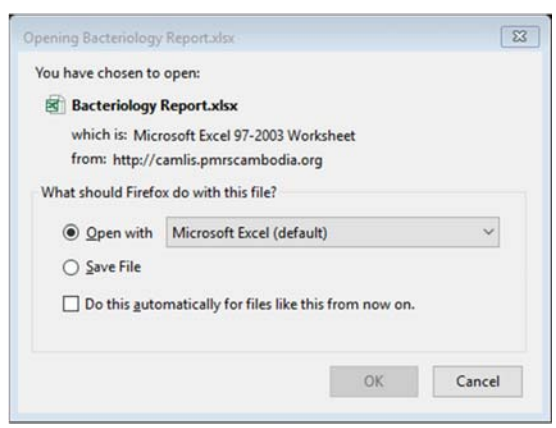
3. Click on "**Bacteriology**" and specify the conditions to be generated by the systemincluding **laboratory, start/end date, Sample number, Sample, and results**".
4. Once finished, click on the button "**Filter**" to open all microbiology results available in the system (see below picture). In this report, only positive results are displayed. To extract other negative results, please proceed to section 6.7



Note : S = Sensitive, R = Resistant, I = Intermediate

								Gram Positive															Gram Negat									
Lab Name	Lab ID	Sex	DOB	Sample	Collection Date	Test Date	Result	Amoxi_Clav	Ceftriaxone	Cephalothin	Chloramphenicol	Clindamycin	Cloxacillin	Erythromycin	Nitrofurantoin	Norfloxacin	Oxacilin	Penicillin	Tetracycline	Trimeth_Sulfa	Vancomycin	Cefoxitin	Ampicillin	Amikacin	Azithromycin	Cefazolin	Cefepime	Ceftazidime	Ceftriaxone 30 GNB	Chloramphenicol 30	Ciprofloxacin	Fosfomycin
BTB	5352-29082017	M	1956-01-01	Blood Culture	27-08-2017	29-08-2017	Burkholderia pseudomallei	S												S								S			R	
BTB	5315-23082017	F	1980-08-17	Blood Culture	22-08-2017	23-08-2017	Streptococcus viridans, alpha-hem.		S		S							I														
BTB	5265-17082017	F	1959-01-01	Blood Culture	15-08-2017	17-08-2017	Escherichia coli	S	R		I									R			R	S		R		I			R	
BTB	5264-16082017	F	1949-08-15	Blood Culture	15-08-2017	16-08-2017	Klebsiella pneumoniae	R	R		S									R			R	S		R		R			R	
BTB	5261-16082017	M	1979-08-16	Blood Culture	14-08-2017	16-08-2017	Staphylococcus aureus				S	I	R	S				R	R	R						R						
BTB	5242-12082017	F	1967-08-12	Blood Culture	11-08-2017	12-08-2017	Staphylococcus aureus				S	R	S	R				R	S	S						S						
BTB	5234-12082017	M	1963-08-11	Blood Culture	11-08-2017	12-08-2017	Klebsiella pneumoniae	S	S		S									R			R	S		S		S			R	
BTB	5175-31072017	M	1986-07-30	Blood Culture	29-07-2017	31-07-2017	Non-fermenting gram negative rods																	S				R			S	
BTB	5175-31072017	M	1986-07-30	Blood Culture	29-07-2017	31-07-2017	Pseudomonas aeruginosa																	S				S			S	
BTB	5175-31072017	M	1986-07-30	Blood Culture	29-07-2017	31-07-2017	Staphylococcus aureus				S	R	R	R				R	R	S						R						
BTB	5173-01082017	F	1954-07-31	Blood Culture	30-07-2017	01-08-2017	Klebsiella pneumoniae	I	R		S									S			R	S		R		R			R	

5. Clik on the button "**Export to excel**" to export data as Microsoft Excel spreadsheet and keep it for further data analysis without affecting the original data source.



6.3 Aggregated report

This report shows total number of laboratories testing from all the wards by sex and age group.

To make this report, do the following:

1. Click on the menu "**Analysis**" and click on "**Report Generation**"
2. A new screen will display for thes users to select type of reports to generate

3. Click on "**Aggregated Report**" and specify the start date and end date
4. After finished, click on button "**Filter**" to display all data that has been found.
5. Click on button "**Print**" to print the results.

6.4 Ward report

This report shows total number of laboratories testing per ward, including consultation ward or inpatient ward. For example, this report can be generated to understand which ward requested “Complete Blood Count test the most?”

To make this report, proceed as follows:

1. Click on the menu "**Analysis**" and click on "**Report Generation**"
2. A new screen will display for users to select type of reports to generate

3. Select the report "**Ward**" and enter start and end date.
4. Click on the button "**Filter**" to display all results found in the system and print them as needed.

6.5 Turn around time report

This report shows average duration of laboratories testing by each test based on the sample collection date, sample received date and result print date. In the table, there is also minimum and maximum duration of testing for each test and distributed by urgent and routine sample of the patient.

To make this report, do the following:

1. Click on the menu "**Analysis**" and click on "**Report Generation**"
2. A new screen will display for the users to select type of reports to generate

3. Select the report "**TAT**" and enter start and end date.
4. Click on the button "**Filter**" to display all results found in the system and print them as needed.

6.6 AMR report

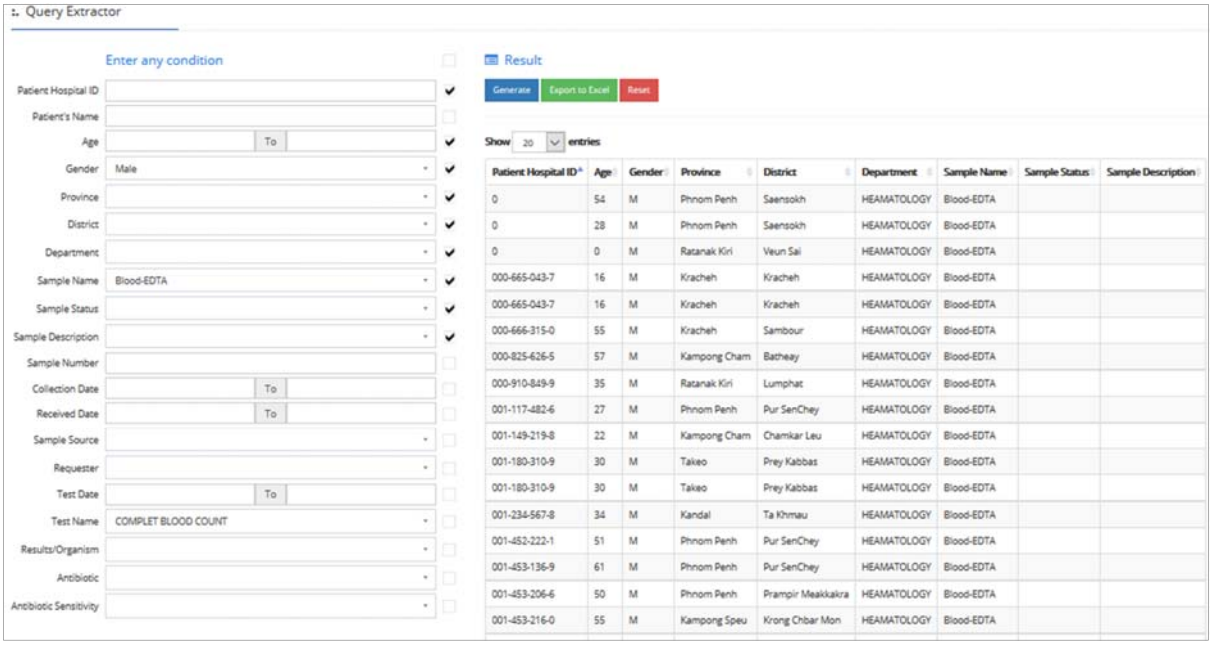
This report is used to support Antimicrobial Resistance Surveillance (AMR) , given the current increase of antimicrobial resistance worldwide. It will display specific information related to patient demographic information, sample type, identified pathogens and antibiotic susceptibility. Users can generate this report and distribute it to other data sources such as data center at WHO head quarter for further analysis and global sharing.

6.7 Query extractor

In addition to all the available reports in CamLIS web based database, data can be further analyzed by using this query extractor. For this purpose, the criteria and the fields to display on the output screen need to be selected. The system will search the data for you and display it. From the output screen, the data can be exported to Microsoft Excel for further analysis.

To work on the query extractor, follow the below steps:

1. Click on the menu "**Analysis**" and click on "**Query Extractor**"
2. A new screen will display for the users to specify the criteria based on the data fields and choose which data fields to display.



3. After all criteria has been selected, click on button "**Generate**". All matching data will be displayed as the above picture by showing the total record number at the bottom. Click on the number of pages to display other pages.
4. Click on button "**Export to Excel**" to export thedata to MS Excel.
5. Click on button "**Reset**" to clear all criteria and outputs.