1. Overview

1.1. Purpose of the system

ACORN is a Wellcome Trust funded project. The pilot phase of ACORN will focus on development, implementation and assessment of enhanced antimicrobial resistance (AMR) surveillance system, including collection of relevant clinical metadata and denominators, as part of routine clinical care in three hospitals in Southeast Asia.

Existing AMR surveillance systems are based mostly on diagnostic microbiology laboratory antimicrobial susceptibility testing results alone, which limits interpretability of resistant proportions. Resulting data fail to give relevant feedback for treatment decisions for local clinicians and do not allow for direct assessment and subsequent modelling of the clinically relevant impacts and burden of drug resistant infections (DRI). Tools to capture and analyse AMR data in low- and middle-income countries (LMIC) are scarce, which hinders engagement with and use of available data.

To fill these gaps, the major aim of ACORN is to develop and test a comprehensive data capture system for patient-focussed AMR surveillance in LMIC settings. Surveillance will include diagnostic stewardship activities. Data collected will harmonise with and expand on the pathogen-focussed WHO Global Antimicrobial Resistance Surveillance System to enable accurate classification of infection syndromes and patient outcomes. These data will be of critical importance to estimate syndromic and/or pathogen outcomes and associated costs: i.e. how many people die from DRIs and how much does AMR cost?

1.2. Purpose of this document

This document focus on requirement specification of data collection components of the ACORN system which including ACORN ODK from, ACORN LIMs and ACORN Data export application.

1.3. System components

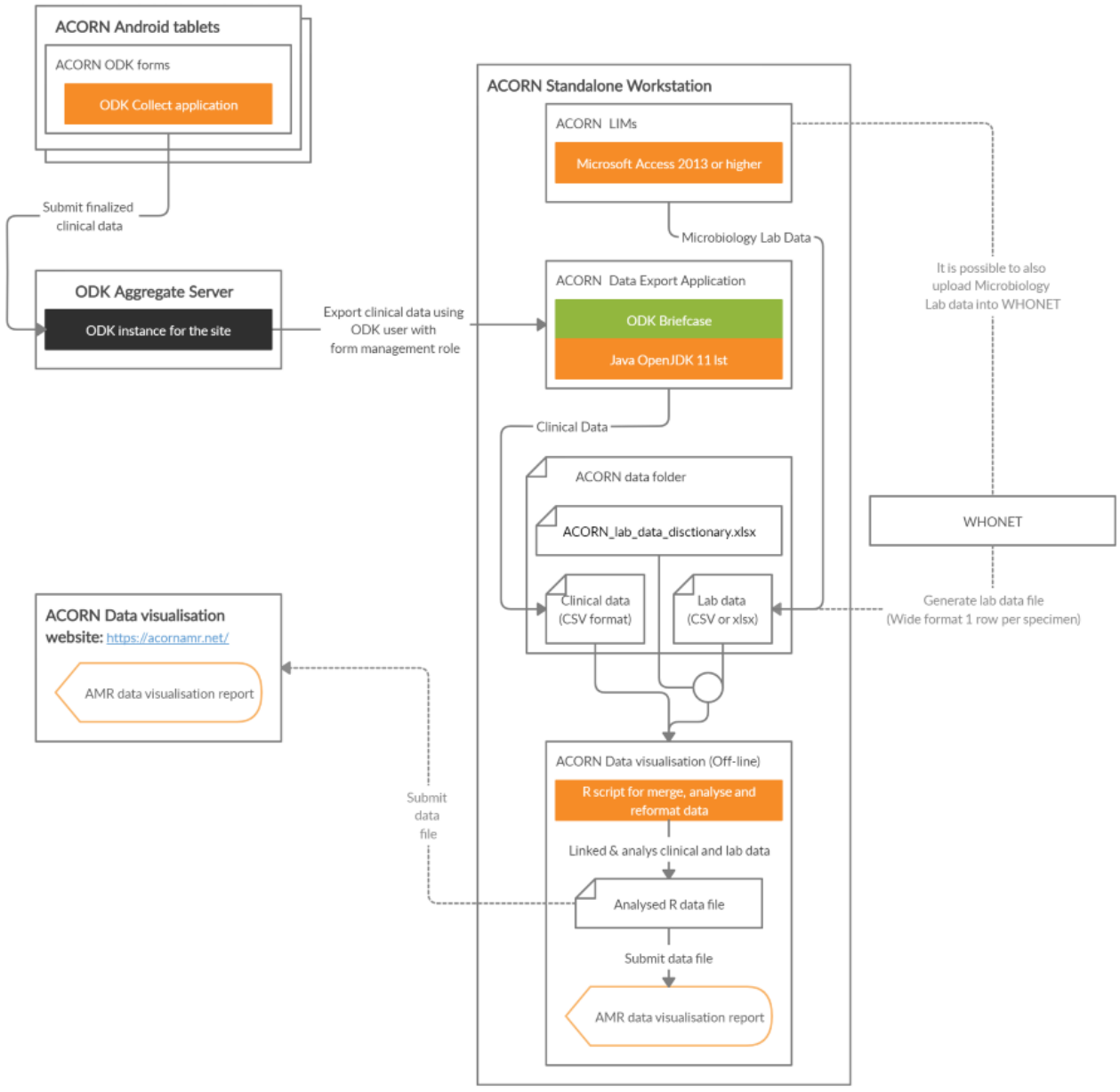


Figure 1-1 System components

From figure 1-1, ACORN Comprises of the following major components

1.3.1. ACORN ODK from – Is a surveillance form create/manage with Open Data Kit (ODK) tool for collect patient-focus clinical data. The data divided into 4 forms – enrollment form, hospital outcome form, 28 days follow-up form and HAI ward survey form. These form will be deployed on an ODK aggregate server instance and can be loaded into ODK collect application on Android mobile phone/tablet to do the surveillance. The surveillance data captured will be consolidated into the ODK aggregate server instance.

In pilot phase, ODK aggregate server is provided by MORU, however, it can also be kept in other ODK aggregate server depending if sites required.

1.3.2. ACORN Lab Information Management System (LIMs) – Is a database application developed in Microsoft Access for collect pathogen-focused microbiology culture results. The application is an additional option for LMIC's microbiology lab for managing their specimen and provide quality microbiology culture results for WHO Global Antimicrobial Resistance Surveillance System (GLASS). The database application is developed based on system developed at MORU for using in Lao-Oxford-Mahosot Hospital-Wellcome Trust Research Unit (LOMWRU) since 2016.

1.3.3. ACORN Data Export application – is a Microsoft Window application for extract patient-focus clinical data from ODK Aggregate server instance as well as extract pathogen-focused microbiology culture results from ACORN LIMs or call other microbiology lab information management system for microbiology culture results data (if applicable).

Both clinical data and microbiology culture results will be in CSV format file ready for ACORN data visualize application to pick up for analysis.

1.3.4. ACORN Data visualization – is a R shinny web application for merge/clean/analyze AMR base on clinical data and microbiology culture result provided.

The application can be divided into 2 parts

- Merge/clean data – This part of the application only run locally at site to merge clinical data with microbiology culture result using patient ID,

enrollment date and specimen date. To merge data, the application requires lab data dictionary for reformat different data structure from either ACORN LIMs or other microbiology lab information management system.

The merged data will then be cleaned to remove all patient identity. The cleaned data will be saved to an R data file.

- Analysis data – This part of the application can run locally at site or run on online web application platform provide by ACORN. The analysis pick up the R data file to generate various infographic represent AMR statistic.

2. Hardware & system software requirements

2.1. ACORN ODK form

- Android mobile phone or tablet device. (Android 4.1 or higher)
- ODK Collect application installed on Android device.
- If not using ODK aggregate server is provided by MORU, an ODK aggregate server instance must be configured and ready for deploy ACORN ODK form.
- For more information about ODK Collect and ODK aggregate please see the documents at https://docs.opendatakit.org/

2.2. ACORN Lab Information Management System (LIMs)

- Workstation or laptop with Window 7 or higher.
- Microsoft Access 2013 or higher (Support either 32bits or 64 bits).

2.3. ACORN Data export application

- Workstation or laptop with Window 7 or higher.
- JAVA OpenJDK 11 LST is properly installed on the workstation or laptop. For more information please see the documents at https://adoptopenjdk.net/
- ODK Briefcase (Version 1.15.0 or higher) is properly installed on the workstation or laptop. For more information please see the documents at https://docs.opendatakit.org/briefcase-install/
- Workstation should be able to connect to ODK aggregate server.

2.4. ACORN Data visualization

- [DETAIL SHOULD BE FILLED IN]

3. Functional Requirements

3.1. ACORN ODK form functional requirements.

Function No.	Category	Requirement
ODK-01	Form list	ACORN ODK form consists of 4 ODK form which are enrolment form, hospital outcome form, 28 days outcome form and HAI ward survey form.
ODK-02	Language	All form should support multi-language for both questions and option for answers.
ODK-03	Version control	Version numbering should be implemented to manage the version update on android device.
ODK-04	Validate	Validation should be apply such as date should not be future date, admission date should be before enrolment date.
ODK-05	Patient ID	Patient ID enter in ODK will be used to map with specimen and culture results in ACORN LIMs, thus, double data entry on patient ID is requires (User must enter patient ID twice with the same value)
ODK-06	Enrolment form	Enrolment form consists of the following question. - Hospital site code - Enrolment date – cannot be future date. - Patient ID - Double data entry. - Date of birth – cannot be after enrolment date. - Age (Years or months or days) – if no information on date of birth - Sex - Admission date – should be before enrolment. - Transfer from another hospital or not with date of hospitalization. - Ward type and name - Comorbidities - Surgery and/or overnight hospitalization with in last 3 month or not

Function No.	Category	Requirement

		- **Surveillance category** - HAI or CAI
		- **Date of symptom onset (HAI)**
		- **Surveillance diagnosis -** Meningitis or Pneumonia or sepsis
		- For adult (Age >= 18 years old) checking on Altered mentation (GCS <15),Respiratory rate (≥22 /min) and Systolic blood pressure (<100 mmHg)
		- For children (Age < 18 years old) checking on abnormal core temperature, inappropriate tachycardia, altered mental state, and reduced peripheral perfusion or prolonged capillary refill time.
		- **Medical devices present on the day of HAI symptom onset**.
		- **Received ≥1 dose of a systemic antibiotic in the 24 hours before the blood culture collected or not**.
		- Information on admission (CAI) or symptom onset (HAI)
		  - **Blood culture collected within 24 hours** or not.
		  - **List of antibiotic prescribed.**

ODK-07	Hospital outcome form	Hospital outcome form consists of the following question.
		- **Hospital site code**
		- **Patient ID -** Double data entry.
		- **Admission date**
		- **Number of surveillance infection episodes** with the following information in each episode.
		  - **Surveillance category**
		  - **Date of enrolment for the episode**
		  - **ICD10 code**
		  - **Surveillance diagnosis**
		  - **Final surveillance diagnosis**
		  - **Sepsis source.**
		- **Discharge date and status**
		- **Total number of days in ICU since admission**

ODK-08	28 days outcome form	28 days outcome form consists of the following question. - **Hospital site code**

Function No.	Category	Requirement
		- Patient ID - Double data entry. - Admission date - 28 days check date and status of patient - Date of death
ODK-09	HAI ward survey form	HAI ward survey form consists of the following question. - Hospital site code - Survey date - Ward type and name - Total number of beds and patients - Mixed ward (Medical, surgical and ICU mixed) or not - If mixed ward specify number of medical, surgical and ICU mixed patients

3.2. ACORN Lab Information Management System (LIMs) functional requirements.

LIMs consists of the following main functionality groups

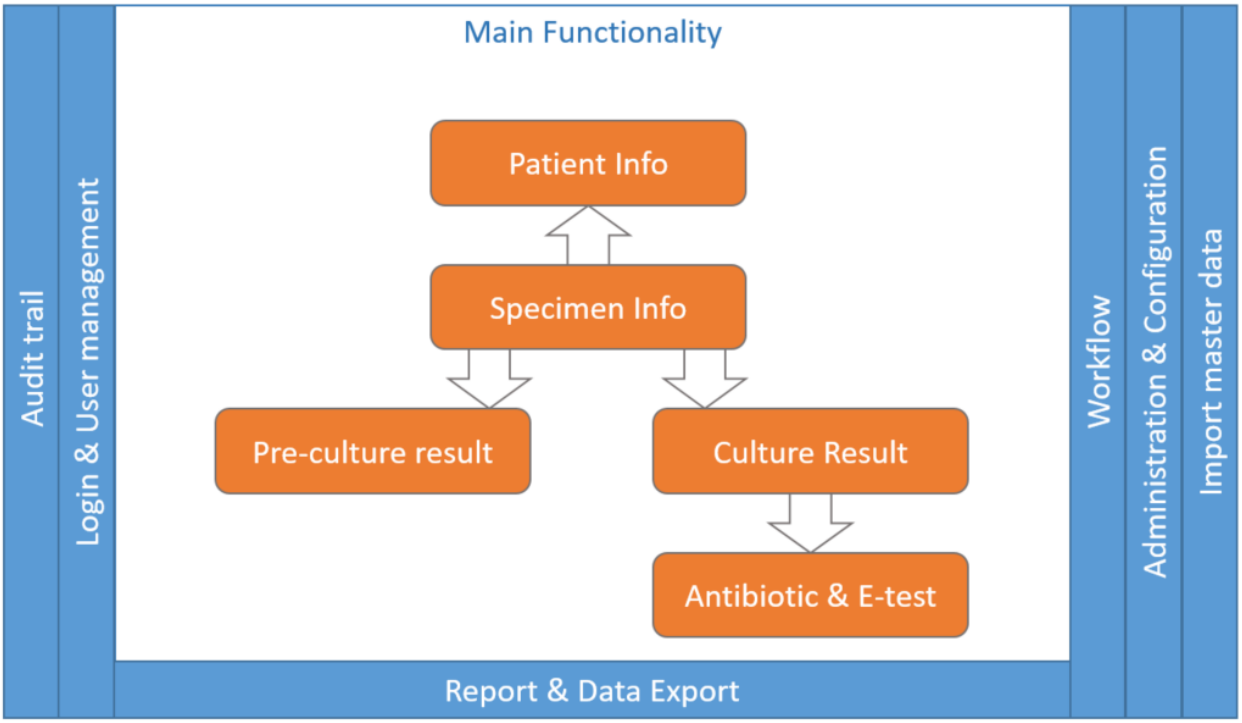


Figure 3.2 - 1 LIMs functionality groups

3.2.1. Login & User management

Function No.	Category	Requirement
USRMAN-01	User login	LIMs should provide screen for user to login with his/her user name and password.
USRMAN-02	User login	User can change his/her password after successfully login.
USRMAN-03	User Management	Administrator user can view list of users, add/edit/delete user logins, set/reset user's password (minimum 7 characters), add/remove user's role & permission.
USRMAN-04	User Management	Role & permission are as following - **Viewer** – able to only view/print microbiology report, workload report, follow-up report and quality report. - **Data entry / Lab technician** – able to add/edit specimen information record. - **Supervisor / 1st reviewer** – able to review and approve specimen information record for final approval - **Doctor / 2nd approval** – able to review and finally approve specimen information record. The record marked as final approved will not be able to change by normal user. - **Administrator** – able to change master data and configuration of the system, able to view audit trail log, able to export data, able to unmarked final approved specimen information record.

3.2.2. Patient information

Function No.	Category	Requirement
PATIENT-01	Patient information	Each patient record consist of the following information. - **Patient idnum** – unique id automatically generated by the database - **Patient name and surname** - **Date of birth (DOB)** - **Gender** - **Address's country administrative division** (Such as state, province, city etc.) can only select from list configured. - **Patient contact number** - **Patient ID** such as HN, Citizen ID etc. - **Study enrollment information** (Study name, study subject ID)
PATIENT-02	Listing and search	Able to list all patient or filtered by - Patient ID such as HN or Citizen ID - Study subject ID - Patient idnum – unique id automatically generated by the database - Patient name and/or surname - Address's country administrative division
PATIENT-03	Add patient	Able to add new patient.
PATIENT-04	Edit patient	Able to edit patient.
PATIENT-05	Delete patient	Able to delete patient. (System should only allow deletion of patient with no associated with any specimen information record.)
PATIENT-06	DOB	DOB can be directly entered or calculate from age (Years, months, days) entered. Patient record using this calculate function will be mark with "DOB from calculation" flag (Please also see issue log : ACORNLIMS-19-03)
PATIENT-07	Address's country administrative division	Support up to 4 levels of administrative division depend on country which the database been deploy. The number of level and caption appear on UI and reports can be configured by

Function No.	Category	Requirement
		administrator user. (Please also see issue log : ACORNLIMS-19-04)
PATIENT-08	Patient ID	Support up to 5 different patient ID. Can configure caption for each patient ID appear on UI and reports. Unused patient ID can be hide. By default ACORN package configure with 2 patient ID, HN and Citizen ID. (Please also see issue log : ACORNLIMS-19-01)
PATIENT-09	Study and study subject ID	For lab in research institute, ACORN support link between patient and research study, he/she enrolled. Each patient may link to multiple research studies with study name and study subject ID keep in ACORN LIMs. (Please also see issue log : ACORNLIMS-19-02)

3.2.3. Specimen information

Function No.	Category	Requirement
SPECIMEN-01	Specimen information	Each specimen information record consisted of the following information. - **Link to patient information** of this specimen - **Idnum** – unique id automatically generated by the database - **Specimen type** – can only select from list configured. - **Specimen number** – can be configured to be automatically generated or manually assigned. - **Collection date** – date and time that specimen was collected. - **Received date and time** – date and time when the lab received the specimen. - **Patient location (Hospital) and ward** – location which the patient admitted. (Location can only select from list configured, however ward can select from list configured or manually entered.) - **Admission date.** - **Clinical contact telephone number** – ward contact number. - **Diagnosis** – Clinical diagnosis. (Diagnosis can select from list configured or manually entered.) - **Site** (site can select from list configured or manually entered.) - **Link to culture result records and a pre-culture result record.** - **Comment and extra note**. (Comment can select from list configured or manually entered.) - **Include in end of day batch printing or not.** - **Blood bottle weight.** - **Status of the specimen in the workflow**
SPECIMEN-02	Listing and search	Able to list all specimen information records or filtered by - Patient ID such as HN or Citizen ID - Study subject ID - Patient idnum - Patient name and/or surname - Patient location

Function No.	Category	Requirement
		- Specimen number - Specimen date range - Specimen type - Microbiology report print date - Status of the specimen in the workflow
SPECIMEN-03	Add specimen	Able to add new specimen by user with permitted user role and status of the specimen in the workflow. Collection date, received date and time will be current date time by default.
SPECIMEN-04	Add specimen	Able to directly add new patient along with new specimen information record.
SPECIMEN-05	Add specimen	In case of exist patient's specimen, user can search for patient record and link it with the specimen.
SPECIMEN-06	Edit specimen	Able to edit specimen by user with permitted user role and status of the specimen in the workflow.
SPECIMEN-07	Delete specimen	Able to delete specimen by user with permitted user role and status of the specimen in the workflow.
SPECIMEN-08	Mandatory information	Mandatory information that must be entered are link to patient information, collection date, specimen type, location, and specimen number. (If not automatically generated.)
SPECIMEN-09	Workflow	Supporting configurable workflow for review and approve specimen result. Note: For more detail about workflow please refer to requirement in section 3.2.8 for more detail.
SPECIMEN-01	Report	Can print microbiology report to printer or into PDF file. Note: For more detail about microbiology report please refer to requirement in section 3.2.7 for more detail.

3.2.4. Pre-culture result

Function No.	Category	Requirement
PRECUL-01	Pre-culture	Each specimen can have only one pre-culture result.
PRECUL-02	Pre-culture	General information for each pre-culture result are pre-culture date (Current date by default) and appearance. (Appearance can select from list configured or manually entered.)
PRECUL-03	Pre-culture	Apart from general information, pre-culture result consists of results in the following categories. - Cell count - Gram stain - Ziehl-Neelsen stain (ZN stain) - Auramine - India ink - Wet prep - Potassium hydroxide preparation (KOH prep) - Microscopy - Biochemistry - Wright's stain - Other results
PRECUL-04	Cell count	Cell count consists of the following information. - White blood cell count (WBC) – Per mm^3 - Red blood cell count (RBC) – Per mm^3 - WBC Qualitative – can select from list configured. - RBC Qualitative – can select from list configured. - Polymorphonuclear count - Mononuclear count
PRECUL-05	Gram stain	Gram stain consists of the following information. - WBC quantity – can select from list configured. - Epi cells quantity– can select from list configured. - Can enter up to 4 Organisms test with gram stain and theirs quantity. (Organism and quantity can select from list configured.)

Function No.	Category	Requirement
PRECUL-06	ZN stain	Ziehl-Neelsen stain (ZN stain) consists of AFB quantity information. AFB quantity can select from list configured.
PRECUL-07	Auramine	Auramine information can select from list configured.
PRECUL-08	India ink	India ink consists of the following information. - India ink result – can select from list configured. - Positive result – found Cryptococcal meningitis – can select from list configured.
PRECUL-09	wet prep	Wet prep consists of the following information. - WBC quantity – can select from list configured. - RBC quantity – can select from list configured. - Can enter up to 4 Parasites test with wet prep and theirs type and quantity. (Parasites name, type and quantity can select from list configured.)
PRECUL-10	KOH prep	KOH prep consists of the following information. - KOH result – can select from list configured. - Fungus found – can select from list configured.
PRECUL-11	Microscopy	Microscopy consists of the following information. - Epithelium quantity – can select from list configured. - Bacteria quantity – can select from list configured. - Yeasts quantity – can select from list configured. - Can enter up to 2 Crystals, their type and quantity found from microscopy (Crystal type and quantity can select from list configured.) - Can enter up to 2 Casts, their type and quantity found from microscopy (Cast type and quantity can select from list configured.)
PRECUL-12	Biochemistry	Biochemistry consists of the following information. - Glucose (mmol/L) - Protien (g/L)
PRECUL-13	Other results	Other results consists of the following information. - Free text for enter other test results. - Free test for enter comment regarding pre-culture results.

3.2.5. Culture result

Function No.	Category	Requirement
CULTURE 01	Culture	Each specimen can have more than 1 culture result
CULTURE-02	Culture	Each culture result consists of the following information. - **Idnum** – Automatically generated unique number - **Positive date & time** - **Organism information** - **Test pattern** – support EUCAST or CLSI guide line using regarding organism. - **Quantity** – can select from list configured (Such as 1+, 2+, 3+ etc.) or manually type-in. - **API/ID Panel, profile and %ID** - Panel can select from list configured. - **Antibiotic (Disc) test results** – can have multiple results regarding antibiotic test pattern. - **E-TEST/MIC test results** – can have multiple results regarding antibiotic test pattern. - **Additional results** such as Batalactamase, ESBL etc. - **Extra notes** - **Comment** – can select from list configured or manually type-in. - **Display in Microbiology report** (Yes or No, default is yes.)
CULTURE-03	Add	Able to add culture result to a specimen. The user should have permission regarding user role and status of the specimen in the workflow to edit specimen information
CULTURE-04	Edit	Able to edit culture result to a specimen. The user should have permission regarding user role and status of the specimen in the workflow to edit specimen information
CULTURE-05	Delete	Able to delete culture result to a specimen. The user should have permission regarding user role and status of the specimen in the workflow to edit specimen information. User cannot

Function No.	Category	Requirement
		delete specimen with either antibiotic (Disc) test result and/or E-TEST/MIC test result.
CULTURE-06	Organism information	Organism should divided into group
CULTURE-07	Organism information	Organism can select from list configured. The default configuration using the same list as in WHONET.
CULTURE-08	Organism information	Organism list include “No growth” and “Consider contaminate” in other result organism group
CULTURE-09	Test pattern	A test pattern (EUCAST or CLSI guide line) should automatically apply per organism or organism group regarding configuration in ACORN database.
CULTURE-10	Test pattern	Able to manually select test pattern from list configured.
CULTURE-11	Additional results	Additional results consist of the following information. - Bata-lactamase (Negative or positive) - ESBL (Negative or positive) - Carbapenemase (Negative or positive) - Inducible clindamycin resistance (Negative or positive) - Serotype - CAZ/CAZ-CV - CPD/CPD-CV - CTX/CTX-CV
CULTURE-12	Other	Culture positive flag should be automatically update regarding comment and organism selected
CULTURE-13	Other	User can add Aliquot ID and strain code regardless of workflow for link with other system or tracking specimen’s sample in storage.

3.2.6. Antibiotic & E-Test

Function No.	Category	Requirement
ATB-01	Antibiotic	Each culture result can have more than one antibiotic (Disc) test result. Each antibiotic (DISC) test result consists of the following information. - Antibiotic code/name – can be only select from list configured. - Measurement in mm - Antibiotic Resistance level – S (Sensitive), I (Intermediate), R (Resistance) - Note - Display in Microbiology report (Yes or No). (Per configuration for each antibiotic, default is yes.)
ATB-02	E-TEST/MIC	Each culture result can have more than one E-TEST or MIC test result. Each E-TEST or MIC test result consists of the following information. - Antibiotic code/name – can be select from list configured. - Measurement in ug/mL - Antibiotic Resistance level (S/I/R) – S (Sensitive), I (Intermediate), R (Resistance) - Note - Display in Microbiology report (Yes or No). (Per configuration for each antibiotic, default is yes.)
ATB-03	Add	Able to add antibiotic (Disc) test result and E-TEST/MIC test result. Permission to add is inherited from culture result.
ATB-04	Test pattern	If test pattern (Either from EUCAST or CLSI guideline) is manually select or automatically selected for the organism in culture result, antibiotic code/name can be automatically add as antibiotic (DISC) test results and E-TEST/MIC test results.

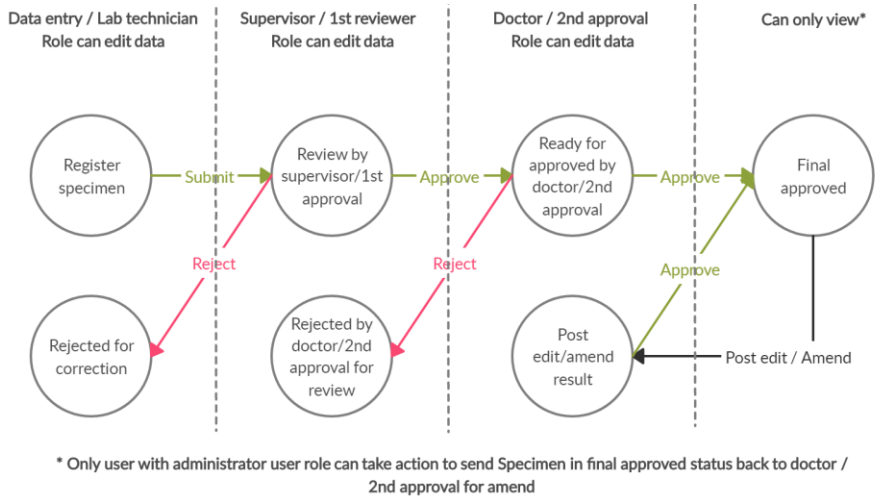
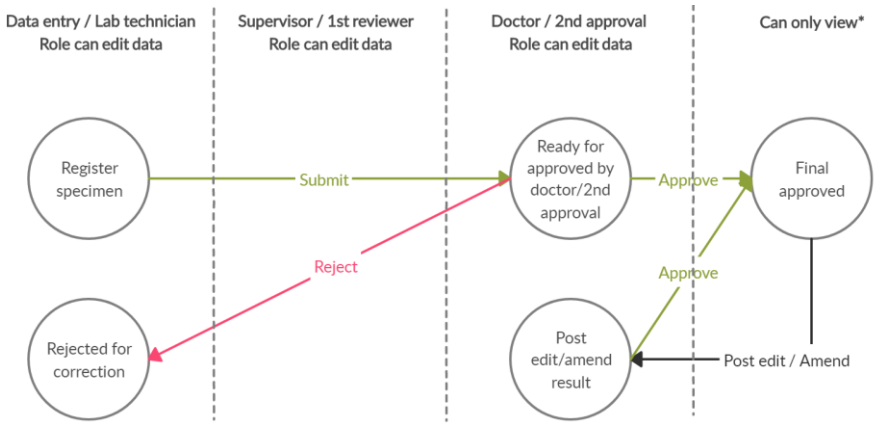
Function No.	Category	Requirement
ATB-05	Test pattern	Antibiotic Resistance level (S/I/R)of each result can be automatically calculate from measurement regarding test pattern's EUCAST or CLSI guideline)
ATB-06	Edit	Able to edit antibiotic (Disc) test result and E-TEST/MIC test result. Permission to add is inherited from culture result.
ATB-07	Delete	Able to delete antibiotic (Disc) test result and E-TEST/MIC test result. Permission to add is inherited from culture result.

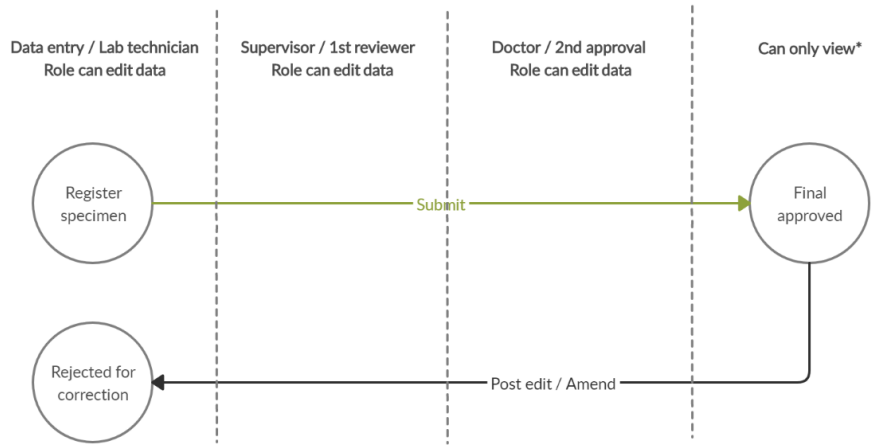
3.2.7. Report & Data export

Function No.	Category	Requirement
RPT-01	Microbiology Report	Able to print microbiology report. Specimen with microbiology report printed will be stamp with print date.
RPT-02	Microbiology Report	Support print to PDF file. (Please also see issue log : ACORNLIMS-19-35)
RPT-03	Microbiology Report	Able to do end of day batch printing of microbiology report for those final approved specimens which not printed yet (No print date). A Print batch number will stamp to all specimen in the batch printing.
RPT-04	Microbiology Report	Able to reprint microbiology report by Print batch number.
RPT-05	Microbiology Report	For specimen not yet finally approved, microbiology report printed will have note “Culture result is pending”.
RPT-06	Microbiology Report	For specimen that been amend after final approved, microbiology report printed will have note that report was amended.
RPT-07	Microbiology Report	Full name of user (Doctor/Physician role) and date of final approval should be display in microbiology report.
RPT-08	Microbiology Report	Will not display culture results, antibiotic (Disc) test results, and E-TEST/MIC test results which display in microbiology report marked as “No”.
RPT-09	Microbiology Report	Report header, Report Page footer and Report footer text can be configured.
RPT-10	Workload report	Able to print monthly workload report. Workload report list number of specimen separated by specimen type.
RPT-11	Follow up report	Able to print follow up report filter by range of specimen date and/or research study. Follow up report list specimen information and their patient information.
RPT-12	Quality report	Able to print monthly quality report. Quality report list number of specimens that been rejected (Poor quality) or consider contaminated separated by specimen type.

Function No.	Category	Requirement
Export-01	Data Export	Able to export specimen information and/or its patient information and/or its pre-culture result and/or its culture result and/or its antibiotic and E-TEST result into Microsoft excel or CSV file format.
Export-02	Data Export	Data Export is in long format.
Export-03	Data Export	Data export can be filtered by the following criteria. - List of Patient location - List of organism group - List of organism - Patient IDs such as HN, citizen ID - Range of specimen date - List of specimen type - Antibiotic - E-TEST - Only final approved specimen.

3.2.8. Workflow

Func No.	Category	Requirement
WF-01	General	Support the following type of workflow for review and approve specimen result. - Double approval. - Single approval. - No review needed.
WF-02	General	Can configure type of workflow to be used per specimen type.
	Double approval	Double approval workflow is as following  * Only user with administrator user role can take action to send Specimen in final approved status back to doctor / 2nd approval for amend
WF-03	Single approval	Single approval workflow is as following  * Only user with administrator user role can take action to send Specimen in final approved status back to doctor / 2nd approval for amend
WF-04	No review needed	No review needed workflow is as following.

Func No.	Category	Requirement
		
WF-05	General	User who take action can enter note for the next user in the workflow.
WF-06	General	Login name of user who take action in each workflow status as well as date time stamp must be recorded.
WF-07	General	Approved date should be automatically stamp when specimen finally approved.
WF-08	General	Approved date and printed date must be reset is post edit/ amend specimen. Also pre-approved date should be set to approve date before post edit/ amend.

3.2.9. Administration & configuration

Function No.	Category	Requirement
ADMINCONF-01	General	Only administrator user role and use all administration & configuration functionalities.
CONF-01	Patient ID	Able to change/disable/enable the use of 5 different patient ID information (For example change the second patient ID from using for enter Citizen ID to enter Admission number (AN) instead.
CONF-02	Address's country	Able to change/disable/enable the use of 4 administration level (For example in Laos, administration level 3 is village when using in Thailand should change to sub district instead.
CONF-03	Specimen number	Able to enable/disable function for automatically generate specimen number. The function should support generate specimen number by specimen type and/or gender and/or patient location and/or specimen (date or month or year)
CONF-04	Microbiology report	Able to configure text on report header, page footer and report footer.
ADMIN-01	Master lookup data	Able to manage (add/edit/delete) lookup value for display in lists using across the application such as in pre-culture result, culture result etc.
ADMIN-02	Specimen type	Able to add/edit list of specimen type as well as select type of workflow for each specimen type.
ADMIN-03	Specimen type	Able to delete specimen type from list if no specimen with this type in database.
ADMIN-04	Organism	Able to add/edit list of organism as well as - Set test pattern for the organism. - Organism in other result group are for mark culture result as no growth or consider contaminated.
ADMIN-05	Organism	Able to delete organism from list if no culture result with this organism result found.
ADMIN-06	Antibiotic & ETEST	Able to add/edit list of antibiotic and E-TEST. Each antibiotic and E-TEST should be notified that it is EUCAST or CLSI standard.

Function No.	Category	Requirement
ADMIN-07	Antibiotic & ETEST	Able to delete antibiotic and E-TEST from list if no culture result with this antibiotic and E-TEST result.
ADMIN-08	Antibiotic & ETEST	Able to configure each antibiotic and E-TEST to be display in Microbiology report by default or not.
ADMIN-09	Test pattern	Able to manage (add/edit) list of test pattern (EUCAST or CLSI guideline) and configuration for automatically calculate resistance level (S\I\R) per antibiotic and/or E-TEST (MIC) using in each EUCAST or CLSI guideline.
ADMIN-10	Test pattern	Able to delete test pattern from list if it is not using for any organism.
ADMIN-11	Administration level	Able to manage (add/edit/delete) list of administration name per administration level.

3.2.10. Import master data

Function No.	Category	Requirement
IMPORT-01	General	Only administrator user role and use all import master data functionalities.
IMPORT-02	Address	Able to import list of administrator levels master data from excel file.
IMPORT-03	Organism	Able to import list of organism from excel file.
IMPORT-04	Antibiotic & E-TEST	Able to import list of antibiotic & E-TEST from excel file.
IMPORT-05	Test pattern	Able to import test pattern (EUCAST or CLSI guideline) from excel file.

3.2.11. Audit trail

Function No.	Category	Requirement
AUDIT-01	Audit trail	Able to keep track of new specimen information record, culture result record, preculture result record added to the database.
AUDIT-02	Audit trail	Able to keep track of change in specimen information record, culture result record, preculture result record made by user. The tracking will keep detail of field name that had been change, its old and new value.
AUDIT-03	Audit trail	Able to keep track of specimen information record, culture result record, preculture result record deleted by user including deletion note entered by user.
AUDIT-04	Audit trail	Able to keep track of add new/change/deletion of user, master data, lookup date and configuration
AUDIT-05	Audit trail	Each audit trail record should have time stamp, user who perform the activity, and record key ID (If applicable such as specimen number, patient idnum etc.)
AUDIT-06	Audit trail	Audit trail log record will kept within a configurable number of days before purge from database.

3.3. ACORN Data export application.

Function No.	Category	Requirement
EXPORT-01	ODK data export	Support export ACORN ODK data record from ODK aggregate server via ODK briefcase into CSV file.
EXPORT-02	ODK data export	Able to configure the following parameter for export data from ODK aggregate server. - Server URL. - ODK user name and password for export data. - List of form to be exported. Each form with form title, CSV file name and directory to be exported.
EXPORT-03	ODK data export	Server URL, ODK user name and password should be kept in encrypted format (AES-256)
EXPORT-04	ODK data export	Support deletion of old exported files and clear briefcase cache.
EXPORT-05	LIMs data export	Able to connect to ACORN LIMs database for export data via Microsoft ACE OLEDB or ODBC driver in CSV format.
EXPORT-06		Able to configure the following parameter for export data from LIMs. - LIM database name and location - CSV file name and location. - ACE OLE DB or ODBC version using for export data
EXPORT-07	LIMs data export	Can filter to export only data since ACORN project enroll to the hospital site.

4. Nonfunctional Requirements

Function No.	Category	Requirement
LNONFUNC-01	Multi user/ Multi workstation support.	By default ACORN LIMs is configure for installed on a standalone workstation for single user. Also MS-Access is mainly design for single user. However, ACORN LIMs can be scalable for multi user/multi workstation use. Thus, ACORN LIMs should design following guideline from Microsoft at https://support.office.com/en-us/article/split-an-access-database-3015ad18-a3a1-4e9c-a7f3-51b1d73498cc
LNONFUNC-02	Security	To prevent open ACORN LIMs database without permission, ACORN LIMs database should be encrypted with password.
LNONFUNC-03	Security	To enhance security, shift key for bypass start-up option in MS-Access should be disable in ACORN LIMs GUI.
LNONFUNC-04	MS-Access	Support both MS-Access 32bits and 64 bits (Version 2013 or higher)
LNONFUNC-05	Limitation	MS-Access is design for small/medium size database.