

Surveillance Outbreak Response Management & Analysis System (SORMAS)

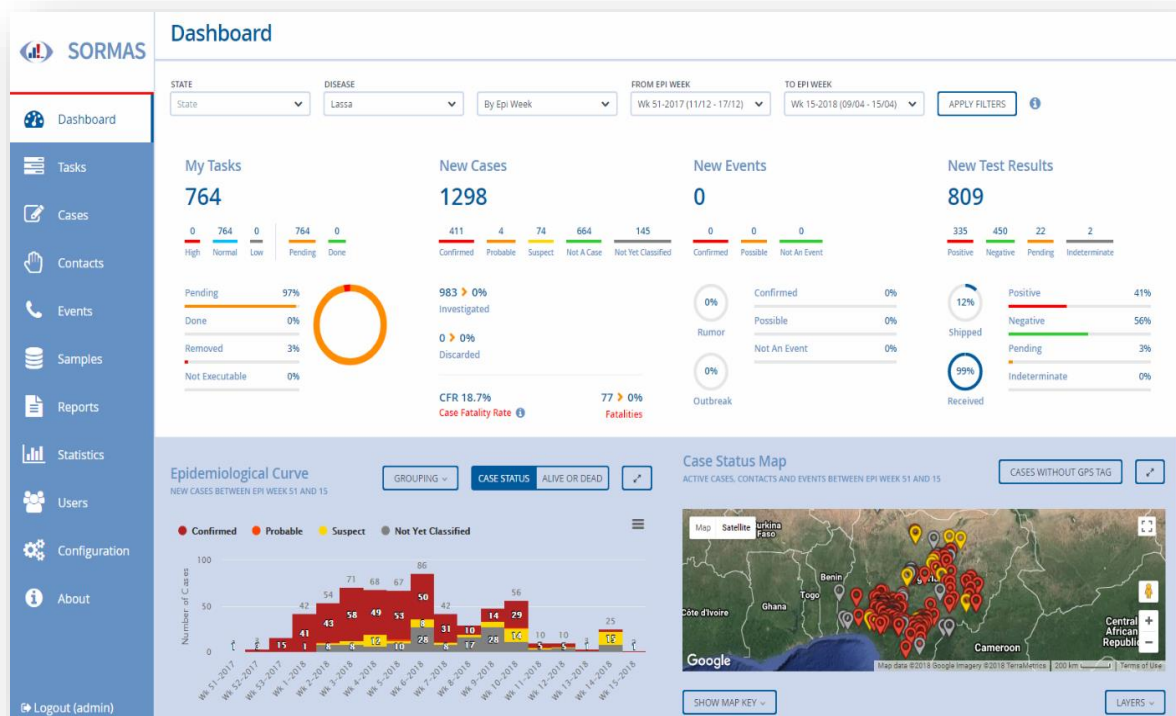
Technical User Manual (2018)



sormas

Surveillance, Outbreak Response Management
and Analysis System

Surveillance Outbreak Response Management & Analysis System (SORMAS®-open) Technical User Manual



A cooperative development project of:

- Helmholtz Centre for Infection Research, Braunschweig, Germany
- African Field Epidemiology Network (AFENET)
- Nigeria Centre for Disease Control (NCDC)
- Symeda GmbH, Braunschweig, Germany

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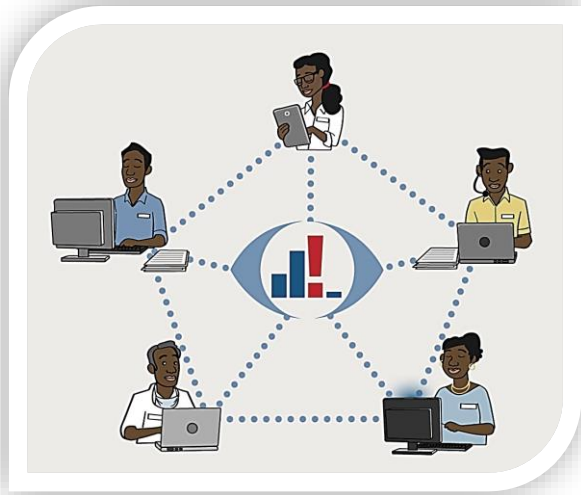
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SORMAS[®]-open – Introduction

SORMAS[®]-open (Surveillance Outbreak Response Management and Analysis System) is an open source mobile eHealth System that processes disease control and outbreak management procedures



in addition to surveillance and early detection of outbreaks through real-time digital surveillance including peripheral health care facilities and laboratories. SORMAS[®]-open includes disease specific process models for 10 high priority epidemic prone diseases and a customizable process model for unforeseen emerging threats. SORMAS[®]-open was developed and implemented jointly by the Nigeria Centre for Disease Control (NCDC), the African Field Epidemiology Network (AFENET) and the Helmholtz Centre for Infection Research (HZI, Germany).

SORMAS[®]-open covers the full portfolio of surveillance and health information management for epidemic prone diseases. Additionally, it is designed to manage outbreak response and to include all relevant layers (peripheral health care providers; laboratories; local, intermediary, national and International public health service). SORMAS[®]-open is the mobile and digital implementation of the Integrated Disease Surveillance and Response (IDSR) System and the International Health Regulations (IHR). A special interphase for laboratories exists in SORMAS[®]-open.

SORMAS[®]-open covers five pathogens of zoonotic origin towards a one-health strategy, which may also include expanding surveillance on antimicrobial resistance.

Training in the context of SORMAS[®]-open already includes clinical diagnosis, disease control and epidemiologic analysis in addition to instructions on the tool itself. The in-built feedback schemes in SORMAS[®]-open provide continuous on-the-job training in the field contributing to qualified human resources within the region. This manual describes the functionalities of SORMAS for clinical diagnosis, disease control, epidemiologic analysis and outbreak response.

SORMAS Mission

The Surveillance, Outbreak Response Management and Analysis System (SORMAS[®]) aims to improve prevention and control of communicable diseases particularly in resource-poor settings. Those involved in public health surveillance and disease control are designing the system. SORMAS[®] is free of charge, adheres to highest data protection standards, good scientific practice, and open access policy.

Technical Features

SORMAS® is being developed on state-of-the-art development tools such as Vaadin 8 framework, JAVA EE Server Payara and PostgreSQL Database. The SORMAS platform consists of two major components, namely, the mobile app (android) which interacts with the Payara Server via a REST-API and a Vaadin web client application. SORMAS® runs on android (OS 5.1 or greater) mobile smart devices, tablets and desktop PCs. The software lifecycle is being implemented via an agile project management cycle (SCRUM) based on multiple design thinking workshops with users, stakeholders, and field pilot evaluations in Nigeria. The software source codes, backlogs and specifications are managed and documented open access under GitHub (<https://github.com/hzi-braunschweig/SORMAS-Open>). An open web-version of SORMAS® with virtual data can be accessed openly for test purposes (<https://sormasorg.helmholtz-hzi.de/sormas-demo.html>).

Functional Features

SORMAS® is a mobile eHealth System that organizes and facilitates disease control and outbreak management procedures in addition to disease surveillance and epidemiological analysis for all administrative levels of the public health system. The following features characterize SORMAS®:

- Real time digitalized notification at health facility level
- Case based surveillance
- Bi-directional information flow
- Contact follow-up management
- Outbreak detection algorithms
- Event based surveillance
- Interoperability with common systems
- Open source
- Mobile offline capability
- Inclusion of all relevant actors (e.g. laboratories)
- User centred design

Interoperability

SORMAS® adheres to data standards of and enhances technical and contextual interoperability with the following systems:

- District Health Information System 2
- Integrated Disease Surveillance and Response
- Mobile Strengthening Epidemic Response System
- International Health Regulations
- Epi Info

User Types (Personas) in SORMAS®-open

In an outbreak response or routine surveillance situation, different functions such as case detection and notification, event management, sample and contact management have to be achieved. SORMAS has different user types, which fulfil specific functionalities. We call these user types “personas”. Personas are defined by their functionalities that are implemented in SORMAS and can be regular staff members during routine surveillance or outbreak response volunteers of different hierarchical levels and with different job descriptions and qualifications. Figure 1 shows SORMAS personas.

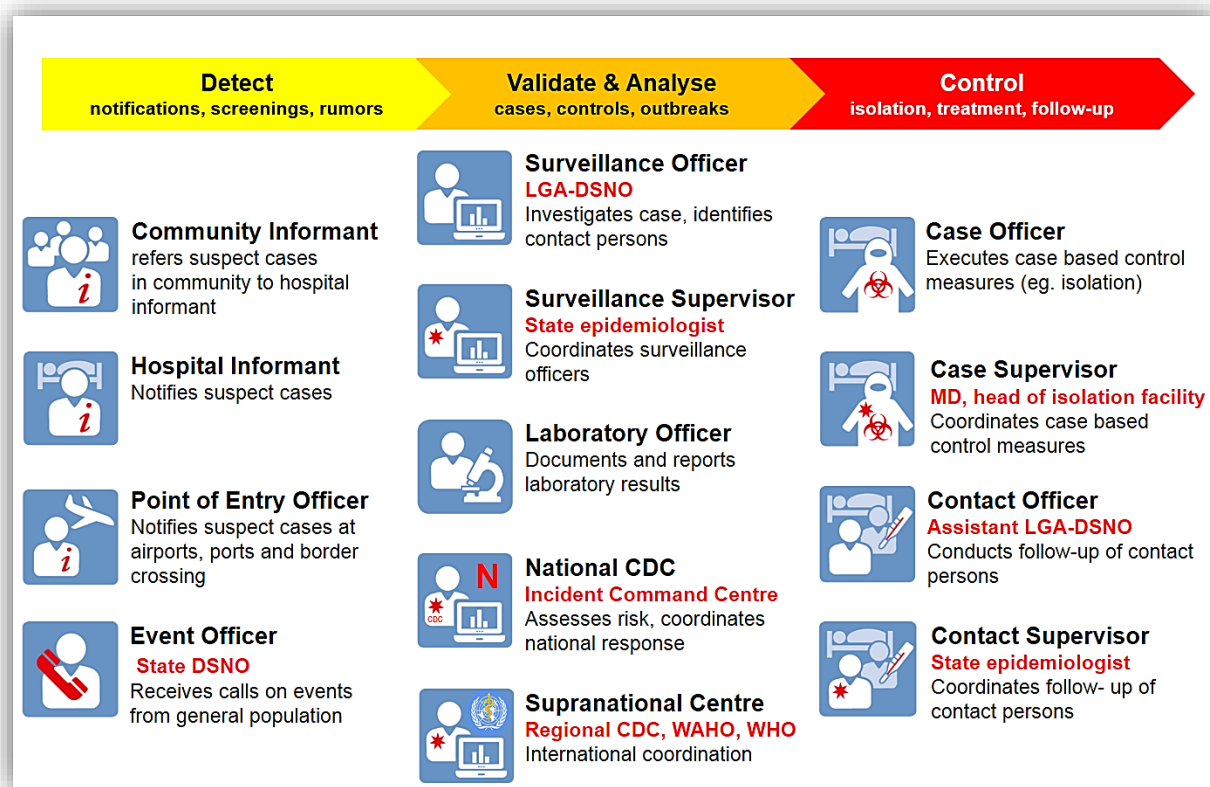


Figure 1: Personas of SORMAS with their functionalities and interactions

We set up SORMAS in such a way to facilitate and guide the flow of information during routine surveillance and outbreak response. Nevertheless, knowing the roles of different actors (personas) is useful. Figure 2 shows the interactions of the personas and table 1 shows their roles:

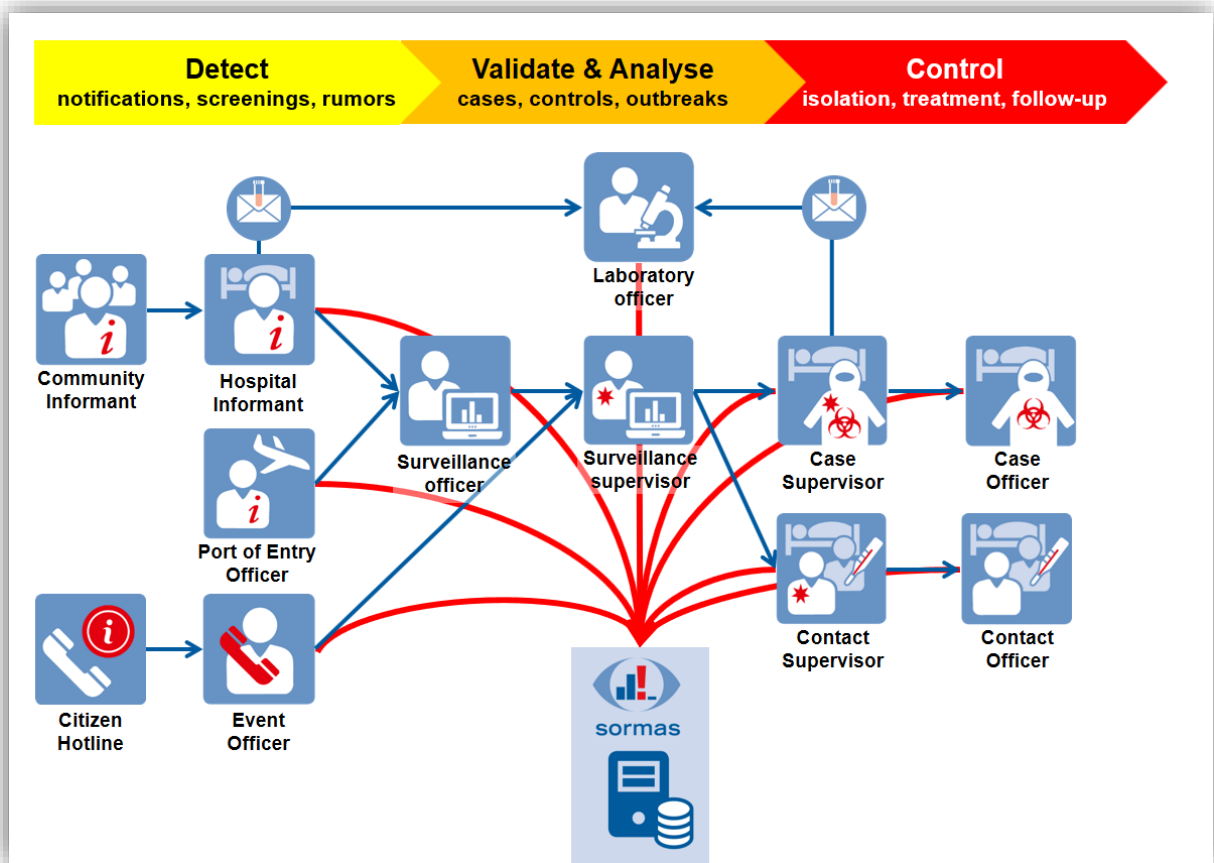











Figure 2: Information flow and interfaces from SORMAS national server

Bi-Directional Information Flow

The SORMAS system based on figure 2 shows a bi-directional information flow from one level to the other. The feedback mechanism that SORMAS generates cuts across the periphery all the way to the top and vice versa. SORMAS users can comfortably use SORMAS knowing that they would be kept updated on every aspect of the case created after case notification, investigation and laboratory testing has been done. Table 1 explains the detailed role of each user and their relationships.

Table 1: Personas of SORMAS with their functionalities and interactions

Persona	Activities	Interaction
Informant 	Looks for disease events in the health facility. Collects information on death or sickness of health care worker.	Reports to Surveillance Officer.
Event Officer 	Conducts initial triage on all incoming events on possible cases.	Reports to the Surveillance Supervisor.
Surveillance Officer 	<p>Reports disease to State Epidemiologist, receives rumors of events on cases and forwards information to Surveillance Supervisor to decide on further investigation.</p> <p>Conducts investigation to verify status of case (e.g. suspect or confirmed) and is responsible for active case finding.</p>	<p>Reports to Surveillance Supervisor.</p> <p>Supervises Informant.</p>
Surveillance Supervisor 	Coordinates the input from Event Officers and Surveillance Officers. He supports event manager in deciding on the investigation on a new event.	<p>Reports to the heads of the unit (Epid/Surveillance and Case Management). The heads are reporting to the Incident Manager.</p> <p>Supervises Surveillance Officer.</p>
Case Supervisor 	Coordinates all necessary steps of handling cases, e.g. triage, transport, lab tests, decontamination. Forwards information about a suspected case to the Contact Supervisor.	<p>Reports to the heads of the unit (Epid/Surveillance and Case Management). The heads are reporting to the Incident manager.</p> <p>Supervises Case Officer.</p>
Lab Manager 	Conducts sample testing and assures exchange of lab results within the SORMAS system for decision of suspected case.	Reports to Case Supervisor.
Contact Officer 	Conducts contract tracing within a particular LGA.	Reports to Contact Supervisor.
Contact Supervisor 	Coordinates the work of the Contact Officers. Informs the Case Supervisor about suspected cases.	<p>Reports to the heads of the unit (Epid/Surveillance and Case Management).</p> <p>Supervises Contact Officers.</p>
Case Officer 	Coordinates safe burials, disinfection, and isolation of patients and decontamination of the environment.	Reports to the Case Supervisor.

Task Management

Task management is a central concept in the SORMAS application. Every persona that interacts with the system will work with task management. In short, every process - Event Management, Contact Management, Case Management - all function by adding, monitoring, and ultimately changing tasks assigned to the individual processes.

The process operates the same way for all the procedures:

- Create the process object, e.g. a case record - by using the 'New Case' icon on the screen. Each case record has an index number, called the Case ID.
- Case records are accessed by the unique case record link on the screen.
- Complete the data entry tasks.
- Save the object.
- Re-open the object, and add the tasks necessary to complete the process.
- Some tasks add themselves automatically, depending on the process.
- These tasks additions have been hardwired into the system, and are considered mandatory.

Software and Hardware Architecture in SORMAS®-open

The vision for SORMAS®-open was to create an open source software that consisted of a server and different **web app** and **mobile app** views for the defined personas. The prototype has been tested and used to demonstrate the handling of realistic scenarios for **Ebola virus disease (EVD), Cholera, Lassa, Meningitis (CSM), Measles and Avian flu (H5N1)** which has now been deployed in Nigeria. See figure 3 for the Nigeria dashboard during Lassa fever outbreak 2018.

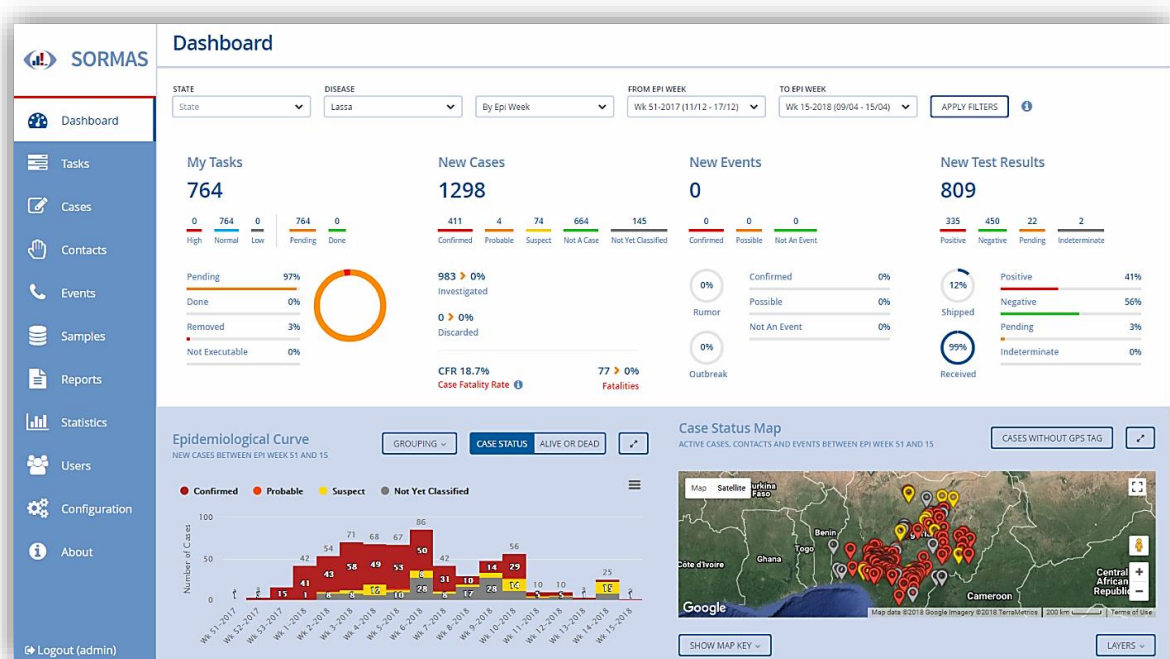


Figure 3: SORMAS-open software web app system dashboard in Nigeria 2018

General Setup

Setup development environment

- Eclipse, Android studio, GitHub Repository (<https://github.com/hzi-braunschweig/SORMAS-Open/>), TRAC (Symeda)
- Set up test server was done on the Symeda server (www.sormas.symeda.de)
- Play server is set up on the HZI server (www.sormas.helmholtz-hzi.de)

Server Backend

Software architecture

- The system has **one mobile app** with different views and features based on the users' roles.
- The system has one or **multiple web apps** with different views and features based on users' roles.
- Layers and projects for **server backend, web apps** and **mobile apps** were defined.

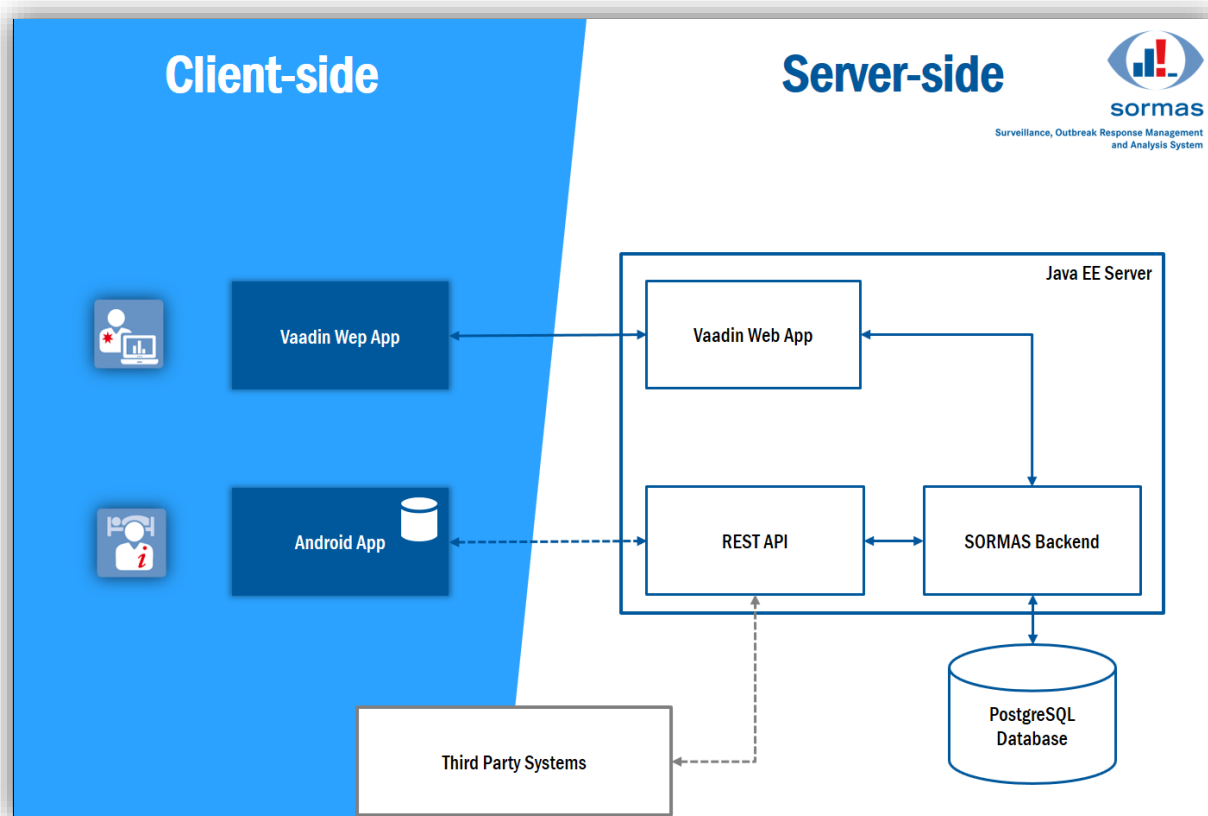


Figure 4: SORMAS-open software system architecture flow diagram

Software Requirements

- UNIX System UBUNTU LTS 16 Server 16GB RAM, HDD efficient, 500GB
- Vaadin Web Client (vaadin.org)
- JAVA EE Server Payara
- PostgreSQL Database (pgadmin)
- CRONJOB Backup
- Android OS 6.1 and above
- Google Chrome Browser (recommended)
- Windows Operating System (recommended)

[\[Link to Data Dictionary\]](#)

[\[Link to Entity diagrams\]](#)

Hardware Requirements

- Large screen (10.1 inches) android tablet/laptop (State level use by Surveillance Supervisor, Contact Supervisor, Lab and Event Manager)
- Mobile internet sticks (Dongles) for Supervisors
- Central Processing Unit (CPU) with 64 bit (x86-64) CPU which can also run 32-bit (x86) version)
- Graphics Card and monitor capable of 1200X 800 minimum
- CD Drive
- Small screen 7.1 inches android tablets (LGA level use by Surveillance Officers, Informants and Contact Officers)
- Sim cards for internet data bundle plans and voice calls communication

Core Database Schema and Disease specified data defined

- Entities represented at least **persons, cases, contacts, interviews, events, lab results**. The relational database management system (RDBMS) schema was created as “flat” as possible.
- A detailed **data dictionary** document of all entities and their fields was developed. For each field a caption was added, short description, user roles allowed to read and write, list of diseases the used field.

Synchronization between mobile app and server was defined

- Entities like cases, contacts, interviews, etc. needed to be synchronized between mobile app and server.
- The mobile app was developed to **work offline** a lot of time, so the needed data (based on role and state of the user) is stored in a **local database** on the phone.
- Identifiers (IDs) are **unique** and **short/usable**.
- The **synchronization** works in a way that minimizes **merge conflicts** and is able to handle them automatically.
- The **corresponding Supervisor** solves **conflicts** the system cannot handle.
- The state of the **synchronization process** is transparent to the user.

📁 Changelog or version management for mobile app and web app instances

- All changes with respect to entities are logged (especially case, contact, person and event) with information on what changed, who made the change and when.
- **Changelog requests** are required for transparency and traceability reasons.
- All information concerning the reporting needs is part of the data model (e.g. change of a case to a certain status).
- Show a detailed log of changes (status, assignments, ...) for a single case or contact.
- Show a report that visualizes the overall status changes for cases over time.
- Show changelog for every entity and field with respect to cases, contacts, events.

📁 ID for case, person, contact and event

- Each of these system elements needs to have a **unique ID**.
- There is a short version (4 to 6 letters) of the id that makes it easy to reference an element in daily communication (e.g. phone call, text or email). See figure 5

CASE ID	EPID NUMBER	DISEASE	CASE CLASSIFICATION	OUTCOME	INVESTIGATION STATUS	FIRST NAME	LAST NAME	LGA	HEALTH FACILITY NAME	DATE
R5XM46	NIE-SOS	EVD	Confirmed case	No Outcome Yet	Investigation done	test	test	Tangaza	Gidan Madi Upgraded Dispensary	13/02
QKCMIN	NIE-SOS	Cholera	Not yet classified	Unknown	Investigation done	test	no 1	Tangaza	Rini Dispensary	14/02
UDV4VM	NIE-SOS	Measles	Not yet classified	Unknown	Investigation done	test	no x	Tangaza	Tunigara Dispensary	14/02
VV6R2U	NIE-SOS-KBE-018-001	CSM	Confirmed case	No Outcome Yet	Investigation done	Almustapha	Ahmad	Kebbe	Kuchi Primary Health Centre	14/02
Q5XEZ7	NIE-SOS-KBE-018-002	CSM	Not a case	Unknown	Investigation done	Aminu	Abdullahi	Kebbe	Kuchi Primary Health Centre	14/02
RXGMH2	NIE-SOS-KBE-003	CSM	Confirmed case	No Outcome Yet	Investigation done	farida	bature	Kebbe	Kuchi Primary Health Centre	14/02
QFVDFG	NIE-SOS-KBE-003	CSM	Suspect case	No Outcome Yet	Investigation done	Hali	musa	Kebbe	Kuchi Primary Health Centre	14/02
TRMQ--	NIE-SOS-KBE-004	CSM	Suspect case	Deceased	Investigation done	James	Abu	Kebbe	Kuchi Primary Health Centre	14/02
W6VUUI	NIE-ZAM-001	CSM	Confirmed case	No Outcome Yet	Investigation done	patients 1	one	Anka	Bagega Primary Health Centre	14/02
R55YAL	NIE-ZAS	CSM	Not yet classified	Unknown	Investigation done	lukama	Muham...	Anka	Bagega Primary Health Centre	14/02
UCKZ4T	NIE-SOS-KBE-005	Lassa	Confirmed case	No Outcome Yet	Investigation done	usman	mani	Kebbe	Kuchi Primary Health Centre	14/02
TK6F4Q	NIE-SOS	Cholera	Not yet classified	Unknown	Investigation done	atul	pimple	Kebbe	Kuchi Primary Health Centre	14/02
QBRW...	NIE-SOS	EVD	Not yet classified	Unknown	Investigation done	John	smith	Sokoto So...	Free Hand Specialist Hospital	14/02

Figure 5: SORMAS-open software system showing unique CASE ID in the case directory

📁 Send Alert for case, person, contact and event

- Alerts are sent via E-Mail. E.g., a new possible case for a Surveillance Officer or a new investigated case for a Surveillance Supervisor.
- In addition to the alert, the corresponding record is highlighted (e.g. case) for the user in the web app or mobile app.

- SMS alerts have been included in addition to the email notification alerts. E.g., the Surveillance Officer is offline a lot of time, so SMS is necessary to make sure he/she is informed.

State (region) Management for health facilities, LGAs (districts) and communities (wards)

- A state (region) has one Supervisor of each type and a list of LGAs (districts) each having a list of communities.
- State (region), LGA (district) and community (ward) is assignable to a case and other entities.

Facility Management for health facilities within LGAs and state

- List, create and edit facilities that can be connected to cases, persons, etc.
- Every facility has a type (primary, secondary, tertiary, and lab) and is private/public.
- There is a mechanism within SORMAS to add new health facilities when a new area is being deployed.

User and user role management for users within the SORMAS system

- Creating and editing users and their user roles is mostly relevant for supervisors. Officers are managed by their Supervisors.
- All information about user tasks, user login information, user interaction and user activities are captured in the database for change management and accountability

User Login Process for users within the SORMAS system

- User accounts can work with or without E-Mail, even though not all users have E-Mail but E-Mail accounts are configured for all users on the tablets to get notifications.
- A complicated password is compulsory. The mobile app saves this encrypted password and protects it with a pin.
- The password is entered once during set up and the pin once created, is used to authenticate access to the tablet every time.

GEOCODING Process for users within the SORMAS system

- The server backend is able to geocode addresses entered into the system, so the user of a web/mobile application does not have to enter latitude and longitude manually on the mobile app.
- We currently use google map framework (<https://maps.google.com>), we intend to migrate to open street maps (<http://openstreetmaps.com>).
- Tasks, events (rumors) and contact/case locations are geo coded on a real time map for case/contact clustering and map analysis. (See figure 6 (map)).

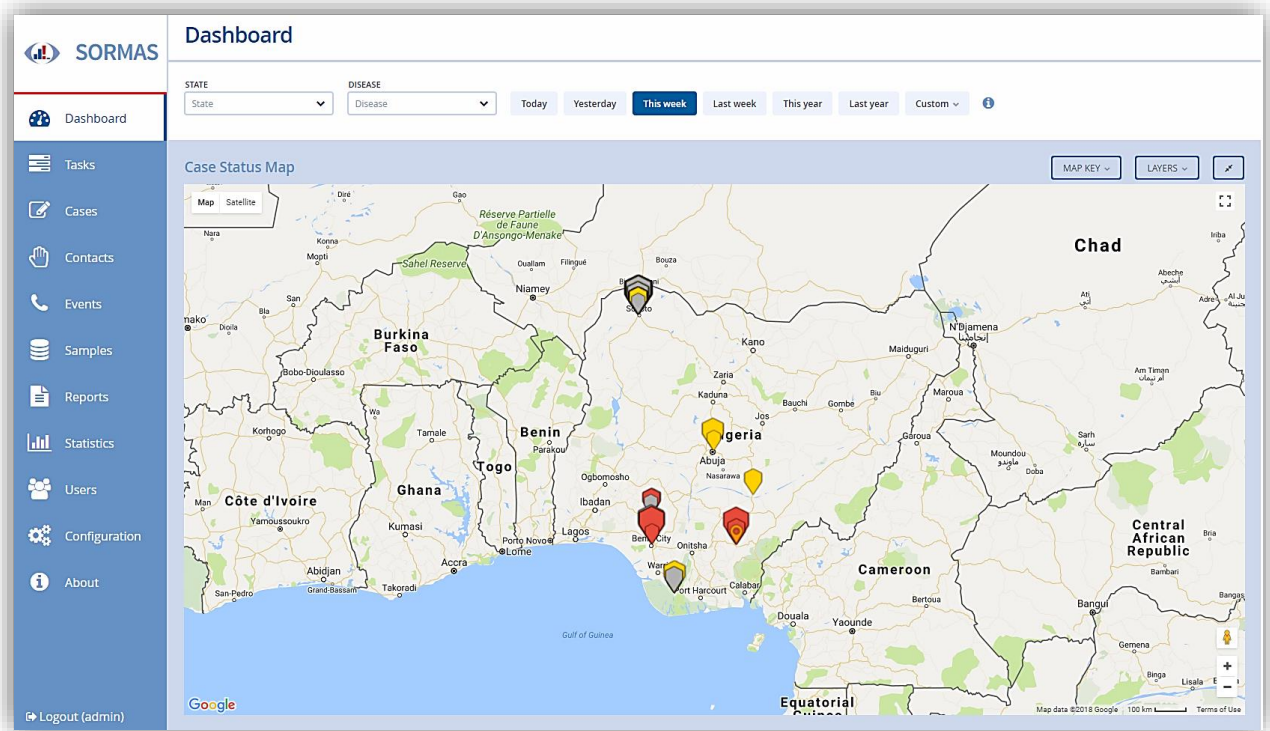


Figure 6: SORMAS-open software system showing geo coded map with case, contact and event information on the dashboard

Statistics, reporting on web app interface

- Exporting of underlying data from one platform to the other (csv, excel, SQL dumps etc.).
- Supervisors are able to log in to a web dashboard to see at a glance every activity, cases, contacts, events that have occurred and can see report summaries of these indicators for immediate action.
- Display of epicurves for epidemiological indicators within a defined query period. This is meant for cases, contacts and events.
- Statistics is done in SORMAS using a SORMASTATS module that provides report in tables, maps and figures. (See figure 7 that shows the statistics and reporting functions.)

SORMAS **Statistics**

STATISTICS DATABASE EXPORT

Filters
Add filters to restrict the aggregated data.
If you use multiple filters only cases that pass all restrictions will be aggregated.

ATTRIBUTE: Onset time | ATTRIBUTE SPECIFICATION: Quarter of year

ONSET TIME (QUARTER OF YEAR): Q1/2017, Q2/2017, Q3/2017, Q4/2017, Q1/2018, Q2/2018, Q3/2018, Q4/2018

ATTRIBUTE: Gender

GENDER: Male, Female

+ ADD FILTER | RESET FILTERS

Visualization

TYPE: TABLE, MAP, CHART | CHART TYPE: COLUMN, STACKED COLUMN, LINE, PIE | SERIES: Gender | X-AXIS: Onset time, Quarter

Options
 Show zero values

GENERATE

Results
● Female ● Male

450



Figure 7: SORMAS-open software system showing statistics, and reporting functions on the dashboard

Export Case data on web app interface

- Exporting of case data allows the aggregation by case status, dead/alive, region, LGA, date, age, sex and all symptoms
- The chronological change of case status is available for every case.
- If the case is created from an event report, and is not confirmed, the event's IDs are provided, to allow an analysis of events persons that turned out to be cases. Figure 8 shows export and statistics functions within SORMAS.

The screenshot shows the SORMAS Case Directory interface. The left sidebar contains navigation icons for Dashboard, Tasks, Cases, Contacts, Events, Samples, Reports, Statistics, and Users. The main content area is titled 'Case Directory' and features a search bar with filters for Outcome, Disease, Case classification, and ID, EPID-number, name, date of. Below the search bar are tabs for 'All' (877), 'Investigation pending', 'Investigation done', and 'Investigation discarded'. A table of cases is displayed with columns: CASE ID, EPID NUMBER, DISEASE, CASE CLASSIFICATION, OUTCOME, INVESTIGATION STATUS, FIRST NAME, LAST NAME, LGA, and HEALTH FACILITY NAME. A red dashed box highlights the 'EXPORT' dropdown menu, which includes options for 'BASIC EXPORT' and 'DETAILED EXPORT', along with 'IMPORT' and 'NEW CASE' buttons.

CASE ID	EPID NUMBER	DISEASE	CASE CLASSIFICATION	OUTCOME	INVESTIGATION STATUS	FIRST NAME	LAST NAME	LGA	HEALTH FACILITY NAME
SZBJXP	NIE-ABS	EVD	Suspect case	Unknown	Investigation done	A Casey	Case	Aba North	Alpha Inland Hospital
V5XL4Z	NIE-ABS	CSM	Suspect case	Unknown	Investigation done	Han	Solo	Aba North	Alpha Inland Hospital
TK65UT	NIE-ABS	EVD	Not yet classified	Unknown	Investigation done	Contact 1	Contact 1	Aba North	Asaokpulo Health Centre
XS6PTU	NIE-ABS	Monkeypox	Probable case	Unknown	Investigation done	Test	Man	Aba North	Asaokpuaja Health Post
WWWFWF	NIE-EBS	New flu	Not yet classified	No Outcome Yet	Investigation pending	da	da	Abakaliki	Akpe Amachi Health Centre
SIBHYF	NIE-EBS	Measles	Not yet classified	Unknown	Investigation done	da	da	Afikpo North	Amaekwu Health Centre
R5XM46	NIE-SOS	EVD	Confirmed case	No Outcome Yet	Investigation done	test	test	Tangaza	Gidan Madi Upgraded Dispensary
QKCMIN	NIE-SOS	Cholera	Not yet classified	Unknown	Investigation done	test	no 1	Tangaza	Rini Dispensary
UDV4VM	NIE-SOS	Measles	Not yet classified	Unknown	Investigation done	test	no x	Tangaza	Tunigara Dispensary
VV6R2U	NIE-SOS-KBE-018-001	CSM	Confirmed case	No Outcome Yet	Investigation done	Almustapha	Ahmad	Kebbe	Kuchi Primary Health Centre
Q5XEZ7	NIE-SOS-KBE-018-002	CSM	Not a case	Unknown	Investigation done	Aminu	Abdullahi	Kebbe	Kuchi Primary Health Centre
RXGMH2	NIE-SOS-KBE-003	CSM	Confirmed case	No Outcome Yet	Investigation done	farida	bature	Kebbe	Kuchi Primary Health Centre

Figure 8: SORMAS-open software system showing case exporting functions on the dashboard

Export contact data on web app interface

- Exporting contact data allows the aggregation by type of contact with source case, contact status (case, under follow-up, completed follow-up, lost follow-up), region, LGA.
- The chronological change of contact status and the connection to the triggering case and change of status from contact to case is also available for every contact.
- If the contact converts to a case, the contact id is linked to the resulting case ID which allows an analysis of contacts who became cases. (See figure 9.)

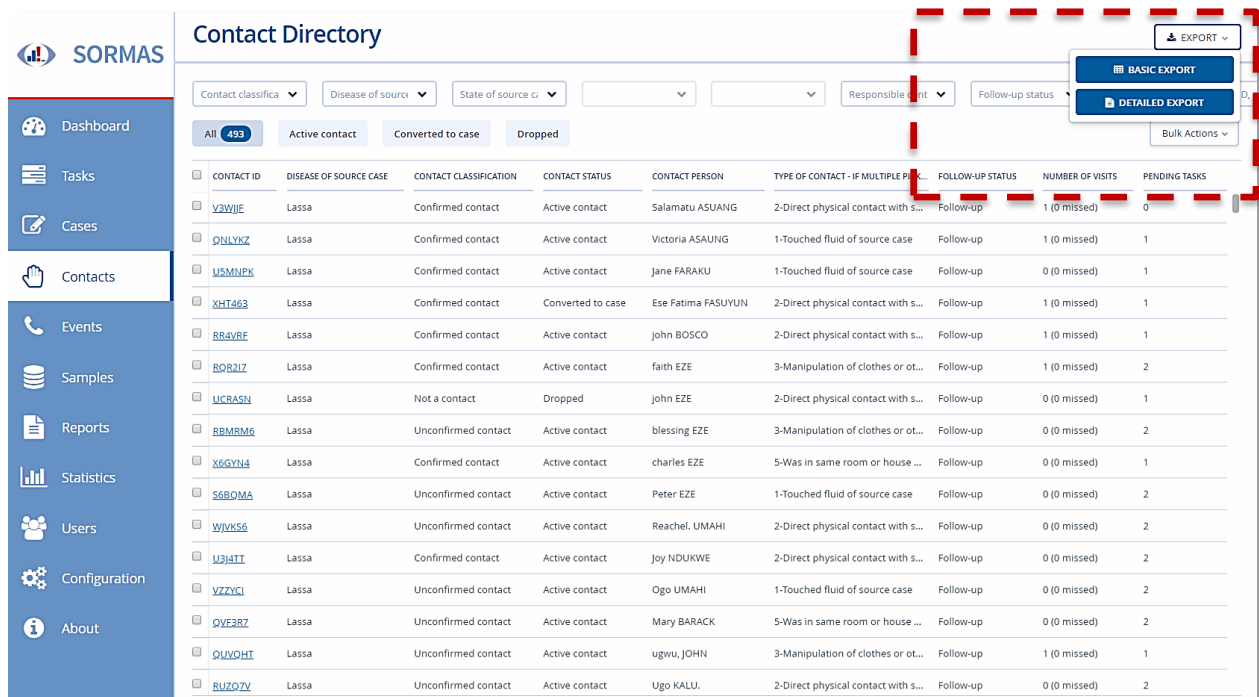


Figure 9: SORMAS-open software system showing contact exporting functions on the dashboard

Export rumor event/alerts data on web app interface

- Exporting event data allows the classification by report date, type of reporter, event status, region, LGA, investigation duration.
- The chronological change of event status and the connection to the triggering case and a probably emerged case is available for every event person associated to an event.
- Input events situation based on phone calls from the hotline.
- Create persons within event situation and investigate to confirm event and if cases are identified, create case record for them. (See figure 10).

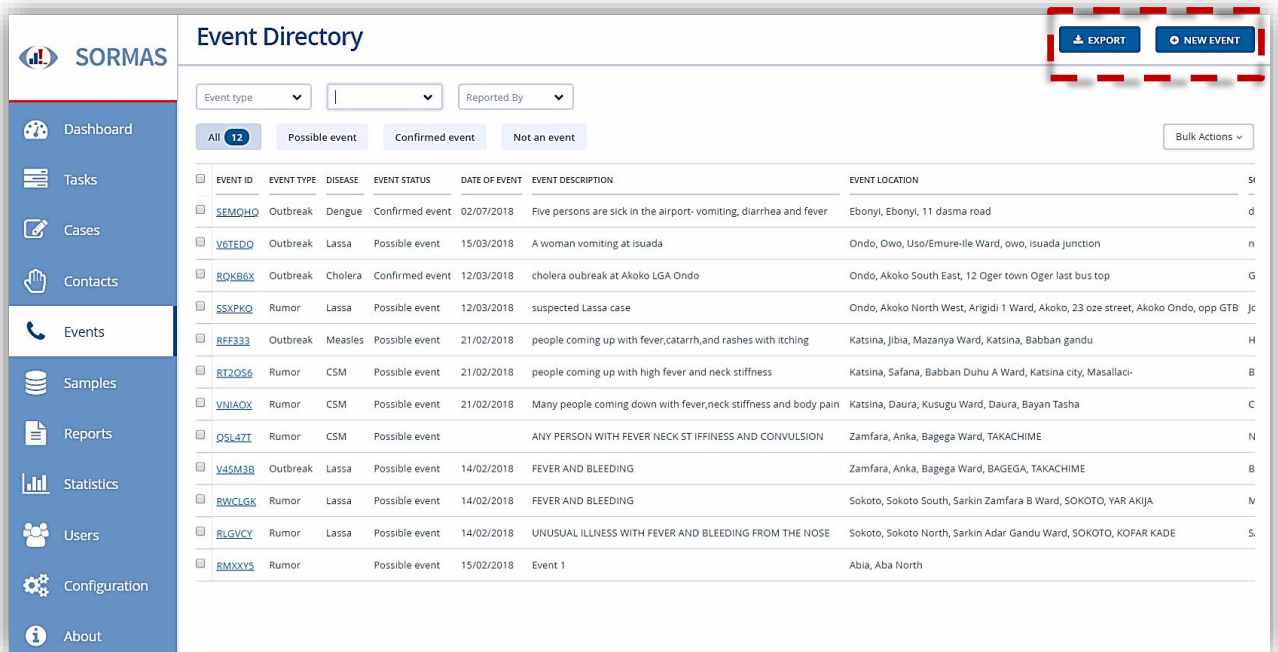


Figure 10: SORMAS-open system showing event exporting functions on the dashboard

Surveillance Supervisor: web app interface

- Task Management - Shows a list of tasks with filters for the Supervisor's tasks and tasks assigned to connected Surveillance Officers.
- Create and edit tasks for Supervisors and Officers.
- List of cases - all cases are connected to their corresponding users who created them.
- Filter for investigated and not yet classified cases that are not assigned to a Surveillance Officer yet.
- Refer cases to other districts or health facilities.
- Filter cases by case attributes.

Dashboard: Visualizing cases in a map

- The map is part of the landing page of the Supervisor dashboard.
- The Supervisor is able to look at the red dots on the map at a glance to know where exactly a new case has just been identified.

View/edit cases: web app

- View and edit all information of not yet classified cases, confirmed cases, probable cases and suspected cases.
- View and edit information on cases, contacts, events, tasks and samples.
- This includes patient information, symptoms, hospitalization information and epidemiological risk factors and exposures. See figure 11.

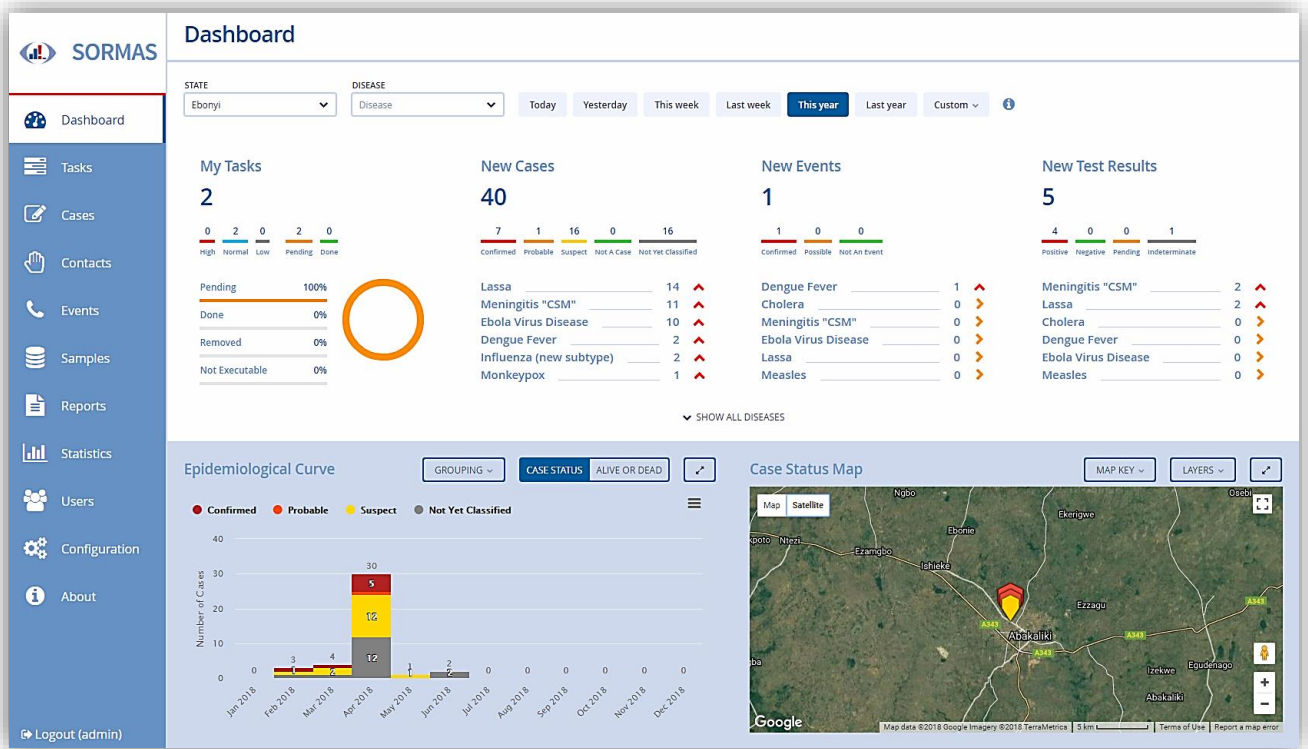


Figure 11: SORMAS-open system showing event exporting functions on the dashboard

📁 Create “not yet classified” cases: web app

- Uses a case investigation form with all case fields. Add GPS data.
- This includes patient information, symptoms, hospitalization information and epidemiological risk factors and exposures.
- Change case state to “suspected” or “not a case” determined by the symptoms, hospitalization and epidemiological factors.
- Assign Surveillance Officer to possible cases that are unassigned. This needs to be done when cases have been created from contacts or events.
- This needs to be done when cases have been created from contacts or events.

The screenshot displays the SORMAS Case Information dashboard. A red dashed box highlights the 'CASE CLASSIFICATION' and 'INVESTIGATION STATUS' sections. The 'CASE CLASSIFICATION' section includes buttons for 'NOT YET CLASSIFIED', 'SUSPECT CASE', 'PROBABLE CASE', 'CONFIRMED CASE', and 'NOT A CASE'. The 'INVESTIGATION STATUS' section includes buttons for 'INVESTIGATION PENDING', 'INVESTIGATION DONE', and 'INVESTIGATION DISCARDED'. Other visible fields include 'CASE ID', 'EPID NUMBER', 'DATE OF REPORT', 'REPORTING USER', 'DATE OF RECEPTION', 'DATE OF CLASSIFICATION', 'CLASSIFYING USER', 'DATE OF INVESTIGATION', 'DATE OF OUTCOME', 'DISEASE', 'STATE', 'LGA', 'WARD', 'HEALTH FACILITY', and 'RESPONSIBLE SURVEILLANCE OFFICER'. At the bottom, there are buttons for 'TRANSFER CASE', 'DELETE', 'DISCARD', and 'SAVE', along with a table of tasks.

EDIT	TASK TYPE	PRIORITY	SUGGESTED START	DUE DATE & TIME	ASSIGNED TO	COMMENTS ON EXECUTION	CREATED BY	SUPERVISOR COMMENT	TASK STATUS
<input type="checkbox"/>	case-investigation	Normal	30/01/2018-16:50	31/01/2018-16:50	National-USER(0)				removed

Figure 12: SORMAS-open system showing case classification or investigation status of case on Supervisor dashboard

Surveillance & Informant management: web app

- List of surveillance Officers and Informants.
- Create/edit user accounts for Surveillance Officers and Informants.
- Assign user persona roles to the Officers created. (See figure 13).
- Create and assign tasks for case investigation, contact and event investigation or follow up to Officers.
- Receive feedback of tasks completed or “not executable”.

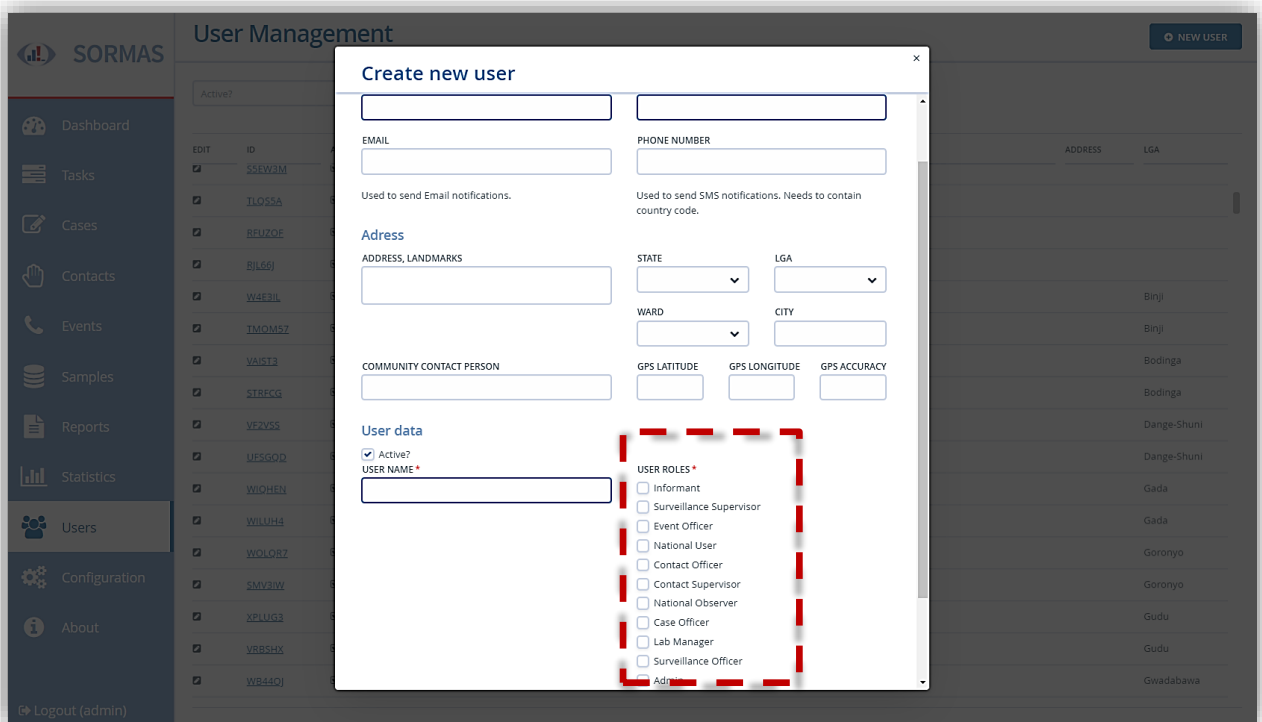


Figure 13: SORMAS-open system showing user creation and assignment within the Supervisor dashboard

Surveillance Officer module: mobile app

- Show all tasks assigned to the Officer.
- View details of each single task.
- Confirm or cancel task.
- All cases assigned to the Officer are shown in a list on the mobile app.
- A filter is enabled to show possible cases and investigated cases with their current case status assigned to them.
- All dead cases are flagged and highlighted.
- An alert notification informs the Officer about new cases and new changes in the system.
- Using the case investigation form to edit an existing case and add more information to the case. GPS data can also be added as well.
- Investigated cases are converted to an investigated state, which is changed when the Officer completes the task.
- Using the case investigation form, all case elements are entered with all case fields. GPS data added as well.
- List of informants - Screen daily received cases and zero reports by informants.
- The Surveillance Supervisor manages the informant users within his/her region.
- Automatic reminders are created as tasks for the informants to be reminded about cases seen for that week or to submit zero reports.

- The Officer uses this function at the end of the week whenever an informant has sent no case or zero report. (See user guide for Surveillance Officer.)

Hospital Informant module: mobile app

- Task list and view- Show all tasks assigned to the informant.
- View details of each single task.
- Confirm or cancel task.
- Create possible case- Use a case investigation form with a subset of the case fields. Add GPS data.
- Enter all information that pertains to the case being created.
- Send zero reports: Done for each week with no new possible case. Case notification for a new week will be denied if case report/zero reports for the past week have not been confirmed (See user guide for hospital informant Officer).

Case Supervisor module: web app

- Task management - Show a list of tasks with filters for the Supervisor's tasks and tasks assigned to connected Case Officers.
- Create and edit tasks for self and Case Officers.
- Confirm or cancel task.
- List of cases - All cases connected. Filter for suspected cases .
- Uses dashboard map to act based on cases and laboratory confirmation tests.
- View, edit and create cases. (See figure 14.)
- Change case state to **probable, confirmed, negative, not a case, discharged, dead**.
- Background: The case needs two negative lab tests to become negative (not done by the system).
- Create contact for a negative case - The system automatically trigger this after a case is changed to negative.
- Case Officer management - List of Case Officers.
- Create/edit user accounts for Case Officers.

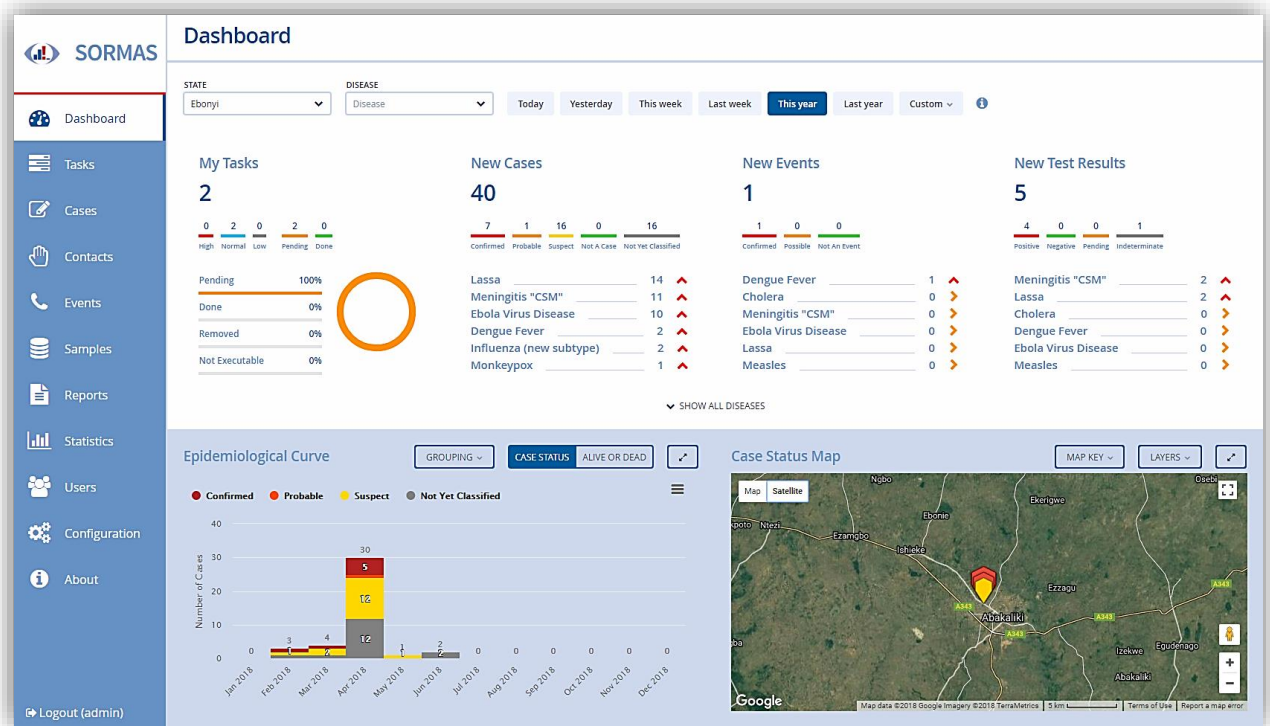


Figure 14: SORMAS-open system showing Case Supervisor dashboard functions

Case Officer module: mobile app

- Task list and view - Show all tasks assigned to the Officer.
- View details of single task.
- Confirm or cancel task. (See user guide for case Officer.)

Contact Supervisor module: web app

- Task management - Show a list of tasks with filters for the Supervisor tasks and tasks assigned to connected Surveillance Officers.
- Create and edit tasks for self and Officers.
- List of suspected cases - Filter to show only cases that do not have contact tracing yet.
- Dashboard - Map of cases and contacts
- Assigns contact tracing for case to Contact Officer.
- List of contacts - Filter for contacts that have no Contact Officer assigned.
- Create and edit contacts.
- Create possible case - The case is automatically assigned to the corresponding Surveillance Supervisor that will assign it to a Surveillance Officer.
- Contact Officer management - List of Contact Officers.
- Create/edit user accounts for Contact Officers.

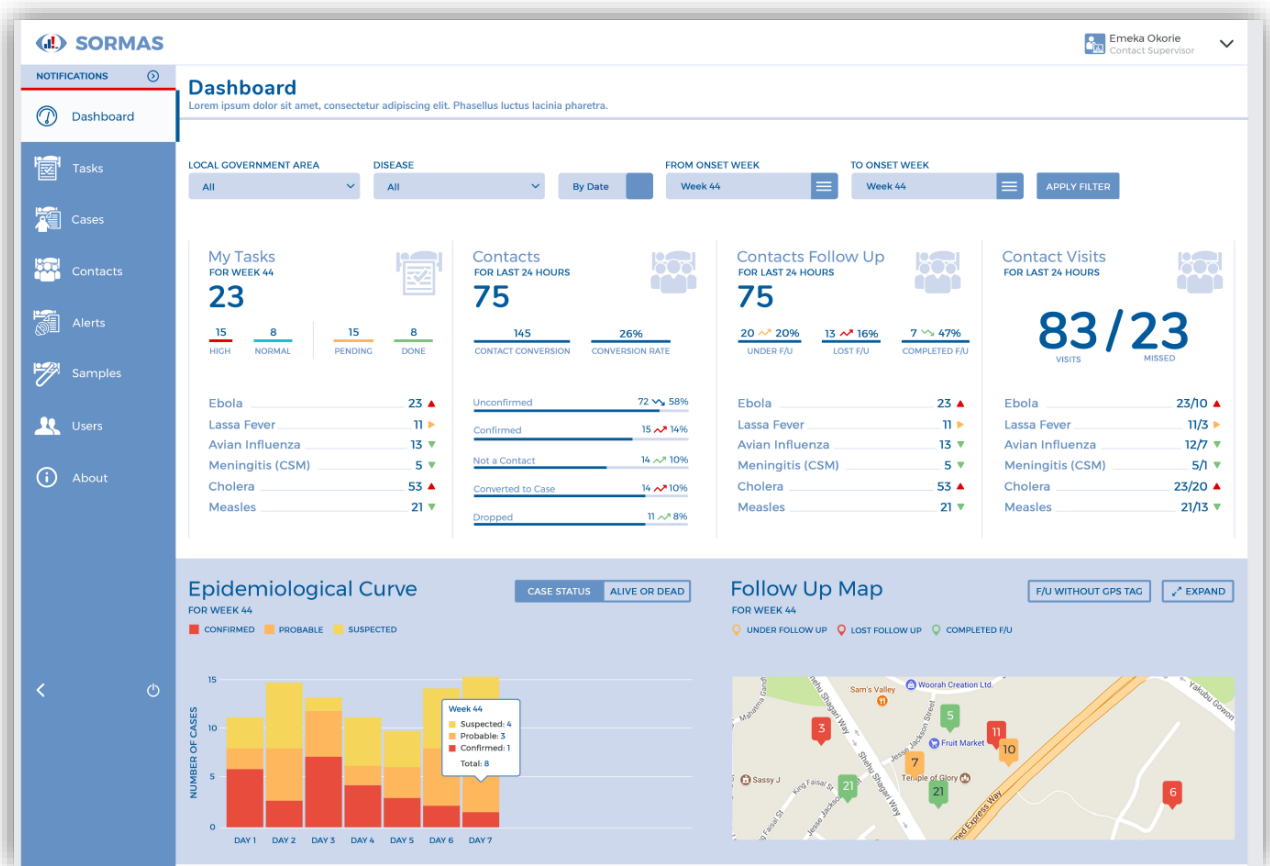


Figure 15: SORMAS-open system showing Contact Supervisor dashboard functions

Contact Officer app module: mobile app

- Task list - Show all tasks assigned to the Officer.
- Create and edit tasks for self and Officers.
- List of cases to do contact tracing
- A list of all cases that are marked for contact tracing
- The Officer will investigate all persons that had contact with this case and create a contact for them.
- Create contact for case - Assign to self or Contact Supervisor (will assign no one).
- Contact list- Filter for contacts to do interview for today, contacts that still need an interview (e.g. tomorrow) and contacts that have completed or cancelled follow-up.
- Name, number, date, scheduled timespan, number of remaining visits
- Do contact interview - First time, demographic, daily check-up (for 21 days). Add GPS data. (See user guide for Hospital Informant Officer.)

Event Manager app module: web app

- Create event - After an event has been reported and investigated, the Event Officer will enter it into the system.

- An event takes place at a location and can have new and existing persons associated with it.
- The Officer enters a description for the involvement and symptoms for each event person.
- Create possible case for person involved in an event- Every person involved can become a possible case once they meet the case definition of symptoms described within the event.
- Event management - List and edit existing events.
- Information about new cases associated with the event is entered into a case investigation form. This is comparable to the case created by an informant. Since the Event Officer has no connection to a Surveillance Officer, the Surveillance Supervisor will handle the case first.

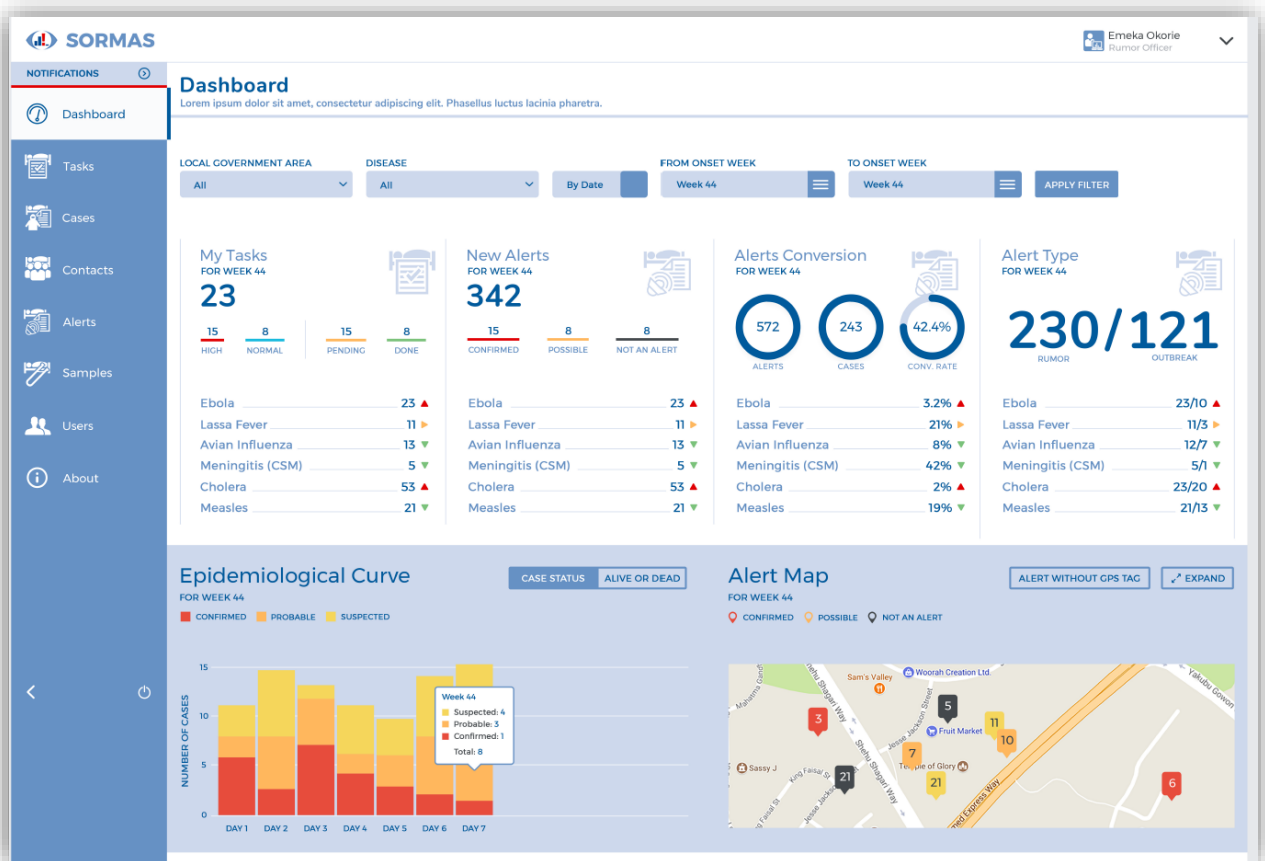


Figure 16: SORMAS-open system showing Event Officer dashboard functions

📁 Laboratory Officer app module: web app

- List of lab results - The lab user can view and edit all lab results he/she has entered into the system. An event takes place at a location and can have new and existing persons associated with it.
- Create lab results - Each lab person in the mobile labs or in the lab facility can enter lab results.
- The Case Supervisor can assign the result to a case and confirm the final lab classification of a case.
- List all samples available, filter by shipment status-
- List samples within case.
- Create or edit sample activity.
- Show last sample test if exists.
- Refer samples to other laboratories.
- Request for more samples from a case to be sent by the Surveillance Officer.
- Create or edit attributes of a sample.

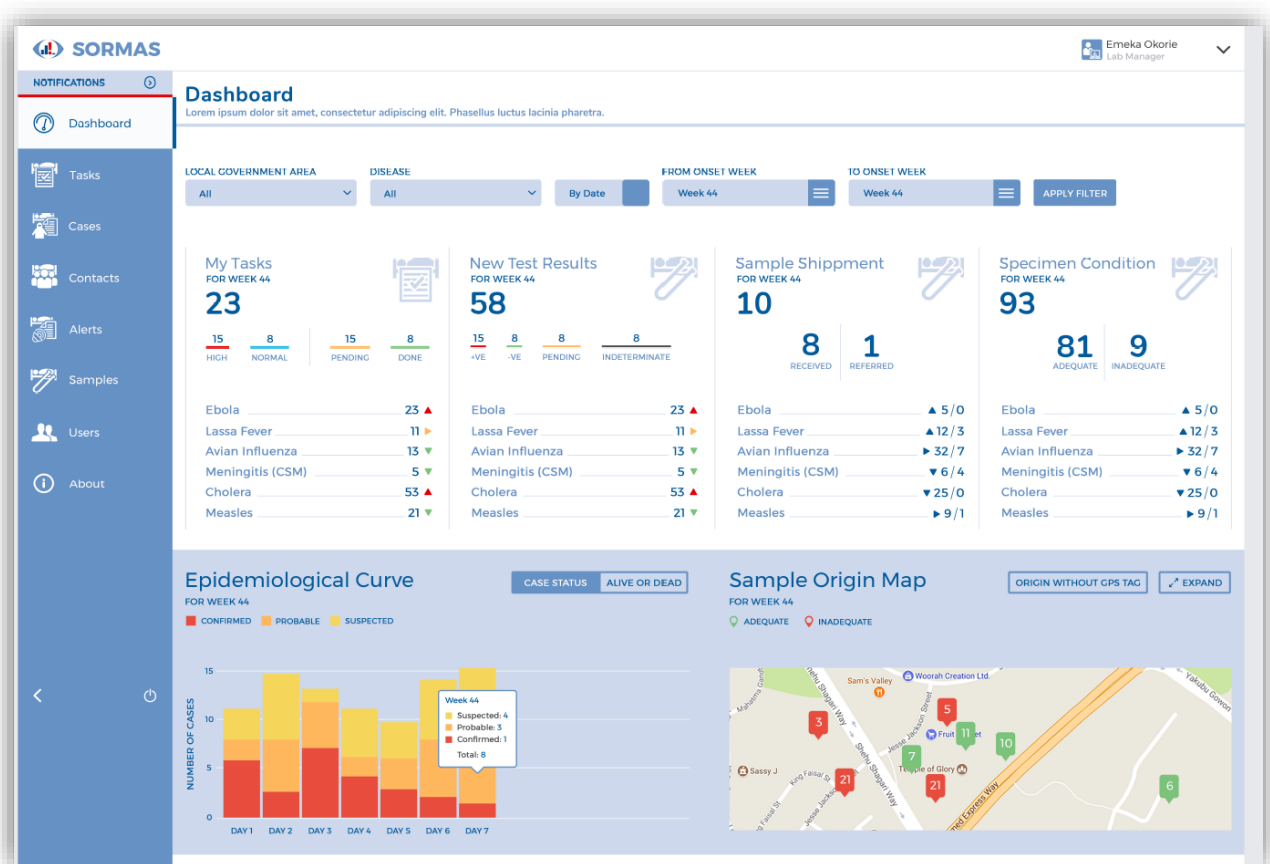


Figure 17: SORMAS-open system showing Laboratory Officer dashboard functions

SORMAS Process Models

Design Thinking Model Development

SORMAS was developed based on an intensive multi-user design thinking methodology. Every process flow or activity algorithm of the user was programmed into the system. The process of coordinating functions into various algorithmic models are called process model. Process models were developed for each disease currently in SORMAS including the work flow of the personas.

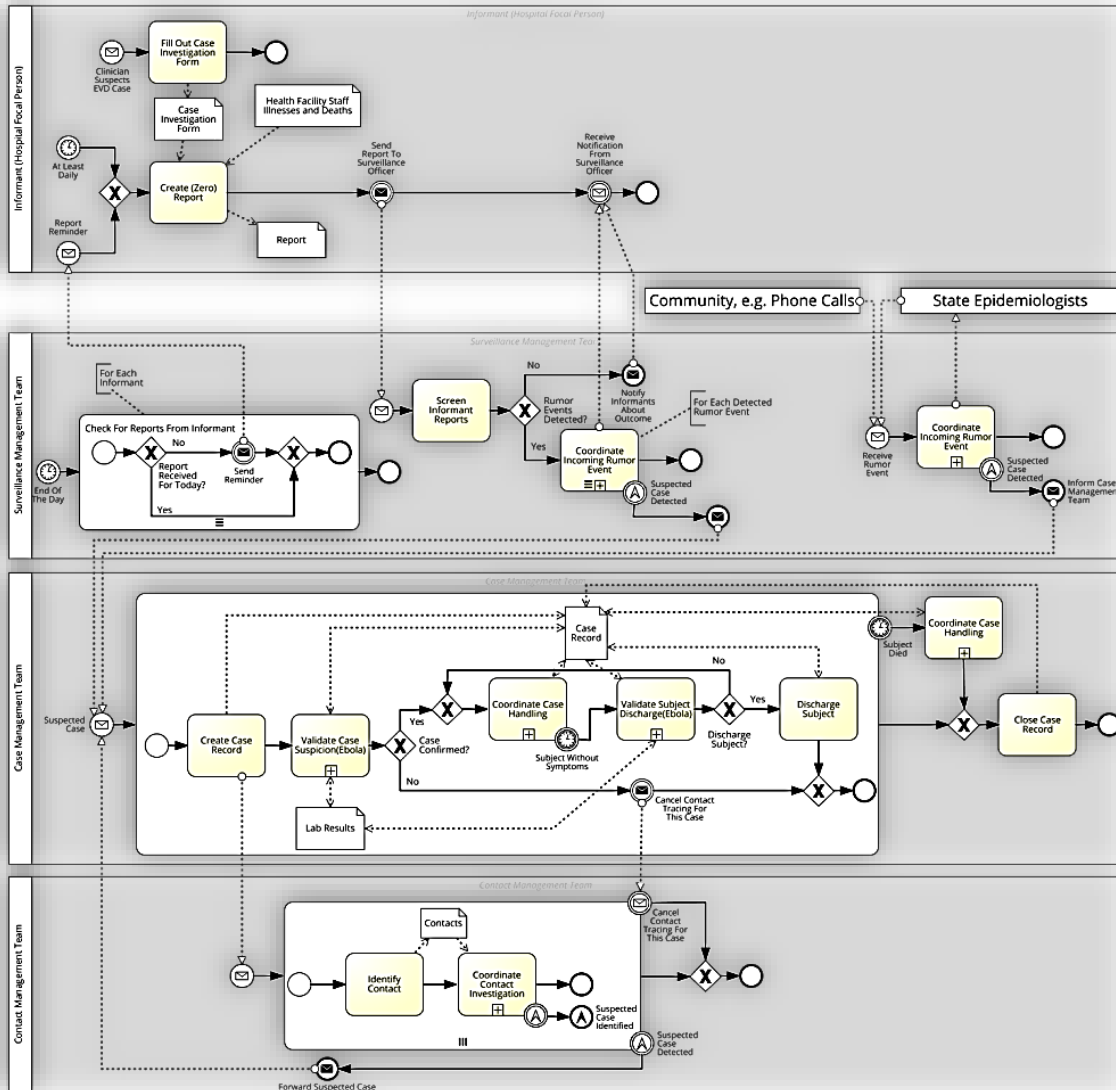


Figure 18: Ebola process model

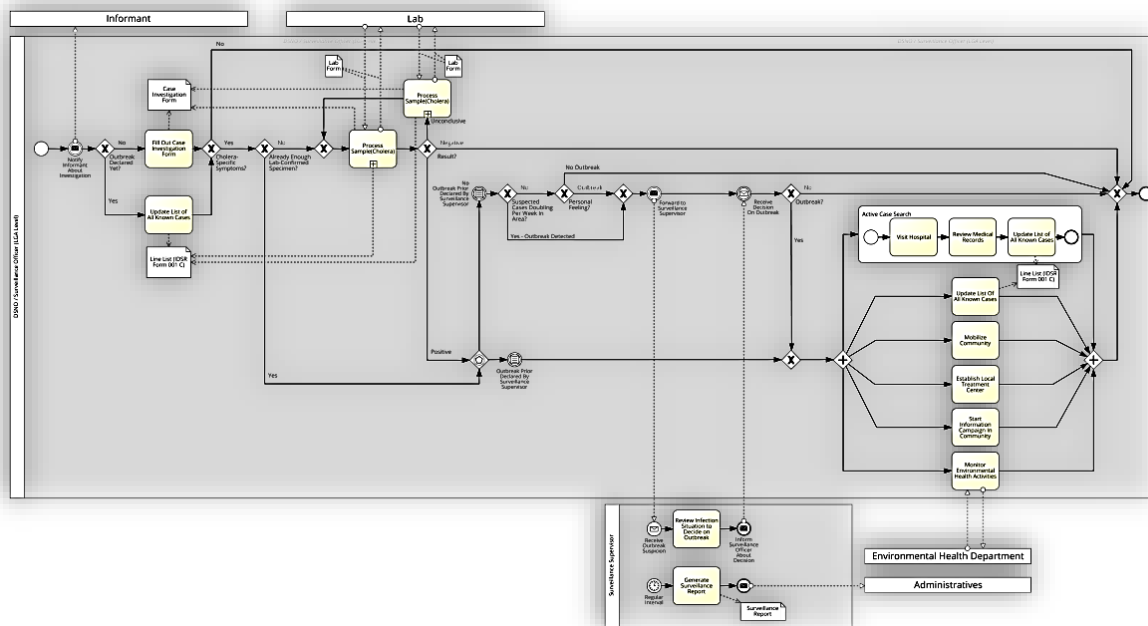


Figure 19: Cholera process model

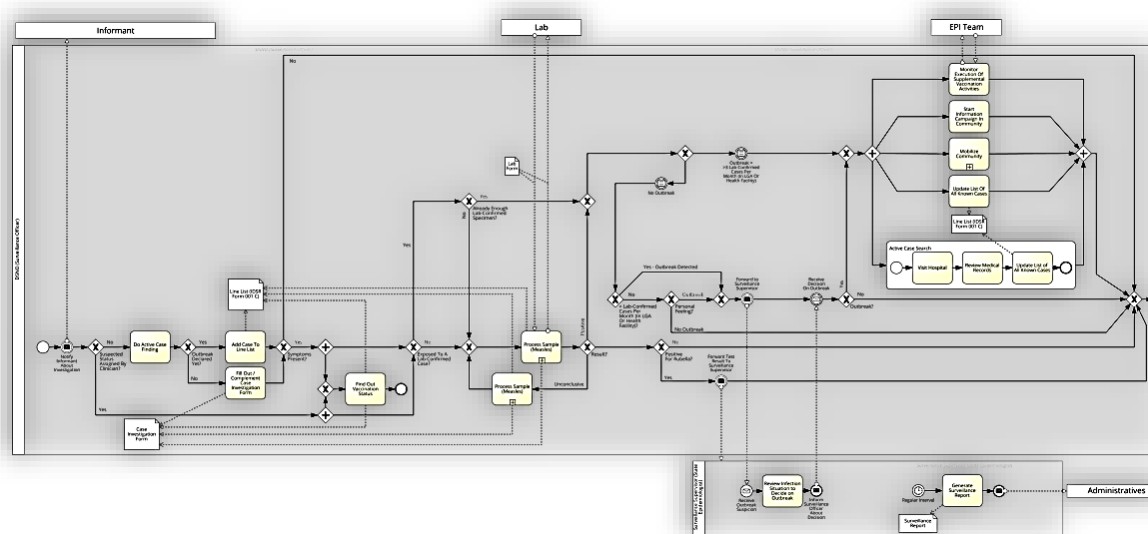


Figure 20: Measles process model

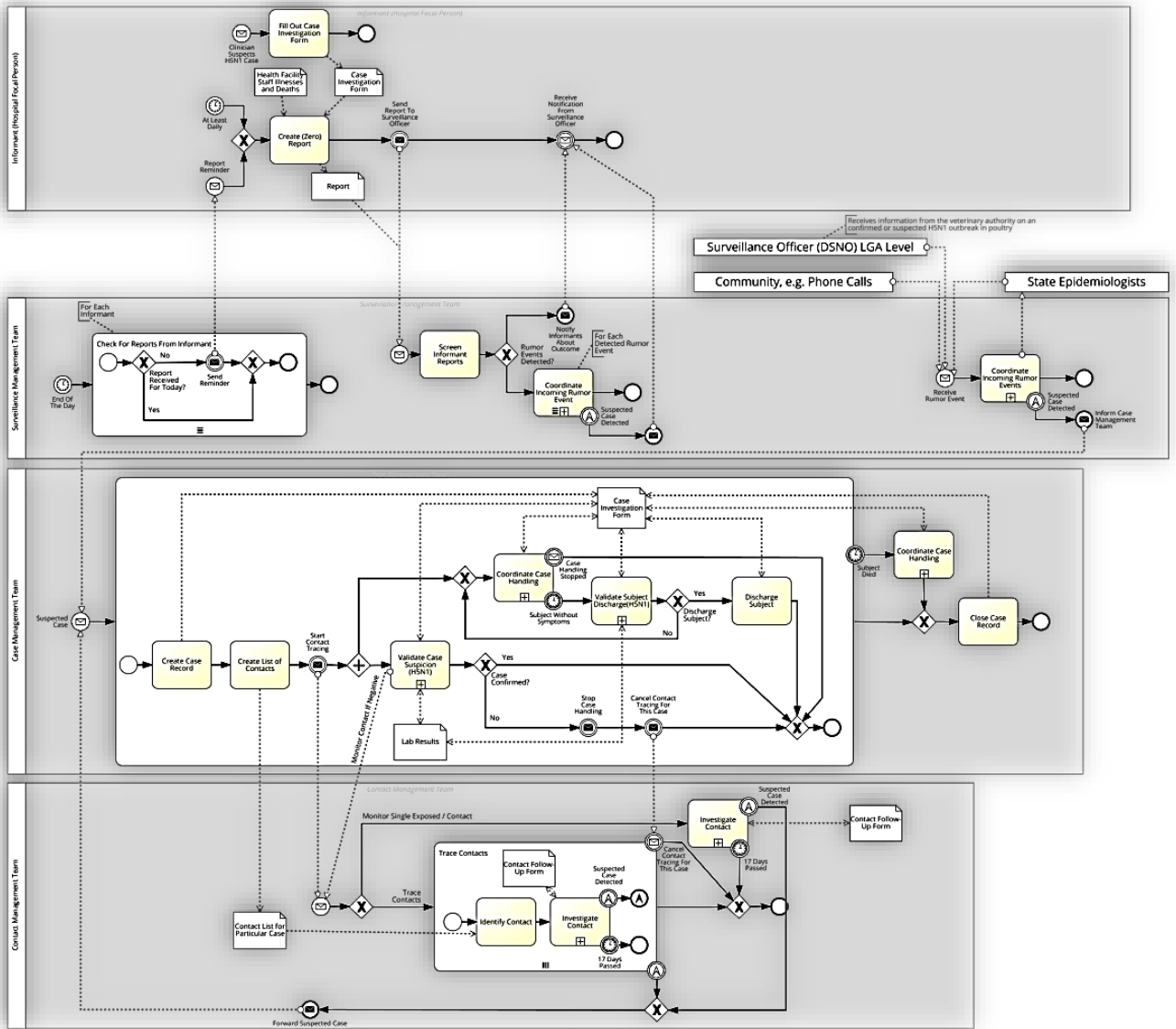


Figure 21: Avian Flu process model