COMMUNITY BASED SURVEILLANCE

Functional Requirements, v2.0

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Executive summary

Building on experience from the current system supporting Community Based Surveillance (CBS) in Madagascar and on input from the CBS-team, several functional areas were found to have potential for improvement.

While the current version is highly passive with the stakeholders having to actively seek information, the new version positions itself as a more integrated and active part of CBS through improved interaction with stakeholders and a more robust data collection strategy that lays the foundation for better analysis, usage and reporting of the ingested data. More specifically, version 2 shall support the following requirements:

- Engage and keep stakeholders informed through a number of event-triggered, scheduled and manually triggered feedback loops by SMS.
- Streamline response and data collection with system supported workflows in the event of alerts.
- Enable better decision making by providing situational intelligence of all ongoing activities, trends and events in areas of interest.
- Report historic and ongoing events and trends shareable with health authorities and other relevant third parties.
- Provide modernized and user-friendly interfaces for data collection and configuration.
- Develop an extensible and future-proof platform.

Introduction

This document defines the high-level requirements for a new version of Community Based Surveillance (CBS). The document describes requirements gathered through workshops and meetings with the following stakeholders:

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- Charlotte Bayegan-Harlem
- Samson Gejibo
- Tine Larsen
- Jah Langleite

The document can be used as the basis for the following activities:

- Creating solution designs
- Developing test plans, test scripts, and test cases
- Determining project completion
- Assessing project success

High-level to-be requirements

Building on the currently in-pilot version of CBS, the next version will extend and enhance several functional areas. On a high-level, four specific areas were identified to have the largest gap between the current version and the to-be.

Workflow support for alerts

Current	To be
All alerts are passive, i.e. a coordinator has to manually check reports in order to know if the number of reported cases have exceed a set threshold value or not. Other than a pre-defined form, there is no system support for collecting data in a structured manner.	The system will autonomously trigger alerts that initiates a pre-defined feedback-response loop to alert the responsible stakeholders and collect the outcome of their investigation. The workflow will support an escalation path from the local health coordinator to the national health coordinator.

Feedback loops

Current	To be
The only working feedback loop is that of reporting back to a volunteer if the case report that was sent succeeded or not.	The system will autonomously trigger tailored feedback on numerous events so to better engage and inform the stakeholders. Additionally, the system will contain a user-friendly interface for directly interacting with volunteers through SMS, both with groups and with individuals.

Data model and integrity

Current	To be
The current data model does not support linkage between the cases that triggers an alert and the outcome of the following investigation. This means that retrospective analysis is less feasible, since the link has to be manually created.	Implementation of system supported alert workflows will increase the value of collected data by linking case reports from volunteers with investigation reports sent from the various health coordinators.

Reporting

Current	To be
Reports give a general overview of situation and activity.	Reports transform data into situational intelligence with historic analytical capabilities, grouping related case reports together with added context from data collected by health coordinators.

User friendliness

Current	To be
The user interface, especially that of the deployed survey tool, is not up to standards with modern systems.	User interfaces on web and app that reflect modern standards.

Functional requirements

This section outlines the functional requirements of the new version of CBS. The requirements are primarily based on user stories, of which the primary purpose is to capture the required system behavior from the perspective of the end-user in achieving one or more desired goals. Some of the use stories are represented visually in diagrams in order to show relationships with other use cases and actors. In addition, some of the processes are backed with sketches and mockups of possible user interface implementations.

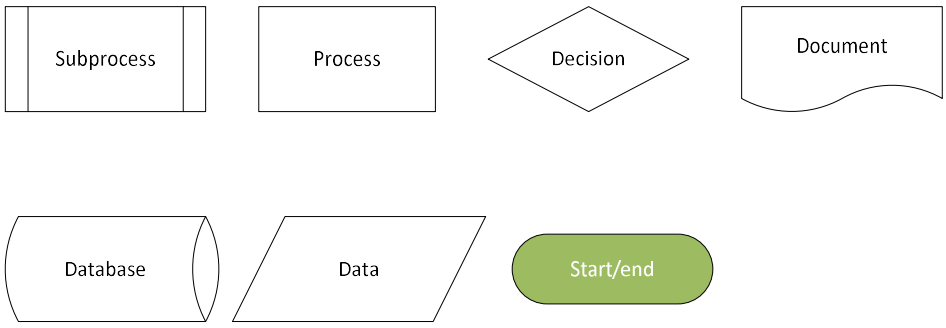


Diagram 1 Legend for diagrams

P01 – New volunteer registration

Registering a volunteer is the process of recording information that will put the cases the volunteer reports in context, like placing it on a map. Volunteers are typically registered after or during a training session held in the field by the Red Cross.

User story #	Activity	Role	User Story	Functional requirements (System shall…)
	Input volunteer information			
	Input volunteer information			
	Received registration feedback			

Table 1 Use stories and functional requirements of volunteer registration (P01)

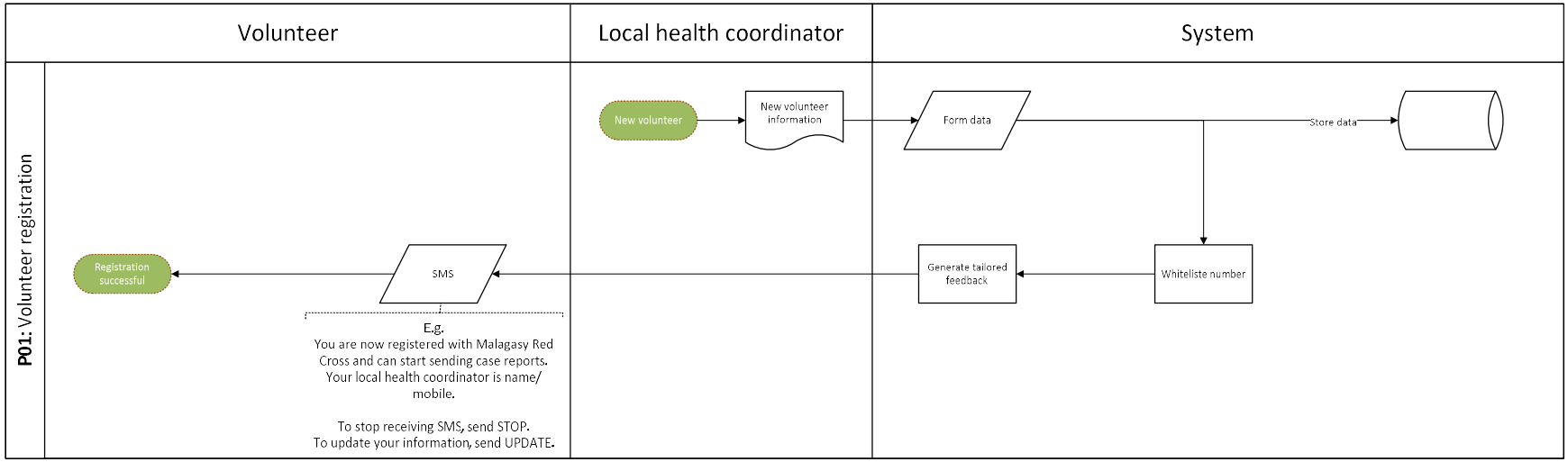


Diagram 2 Volunteer registration (P01)

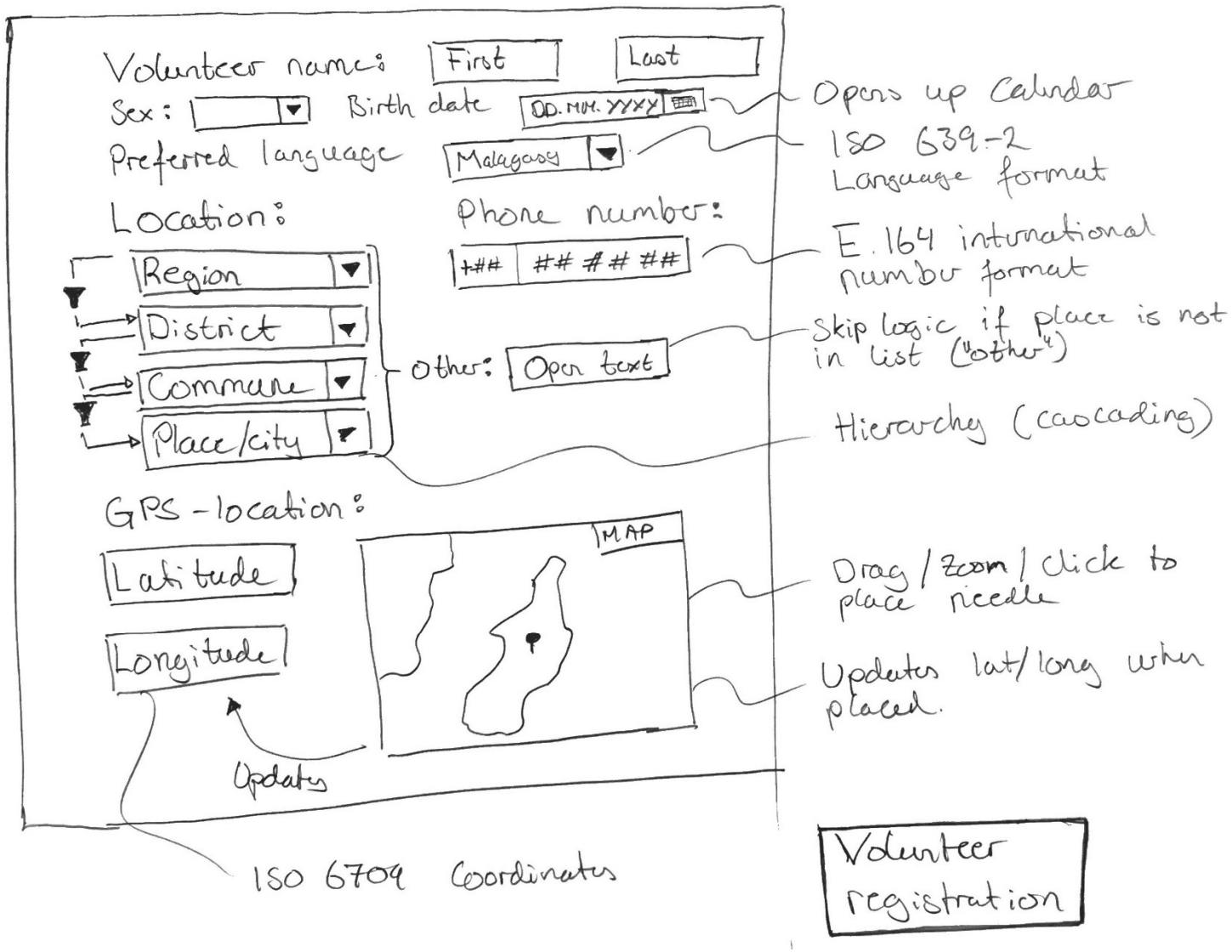


Figure 1 Conceptual mockup of form for volunteer registration

P02 – Volunteer status update

If the volunteer for some reason no longer want to be an active member of CBS, the system will allow the volunteer to self-deactivate. For Red Cross, this serves as an important feature since good surveillance coverage is important and recruiting efforts will be undertaken if certain areas are below what is acceptable.

User story #	Activity	Role	User Story	Functional requirements (system shall…)
	Update volunteer status			
	Feedback			

Table 2 Use stories and functional requirements of volunteer status updates (P02)

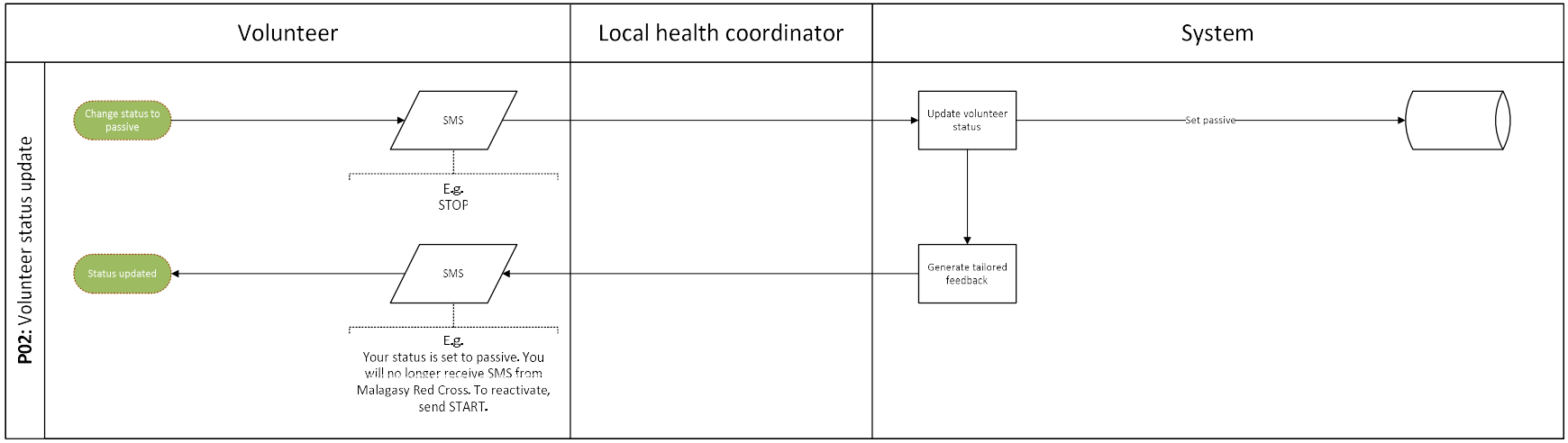
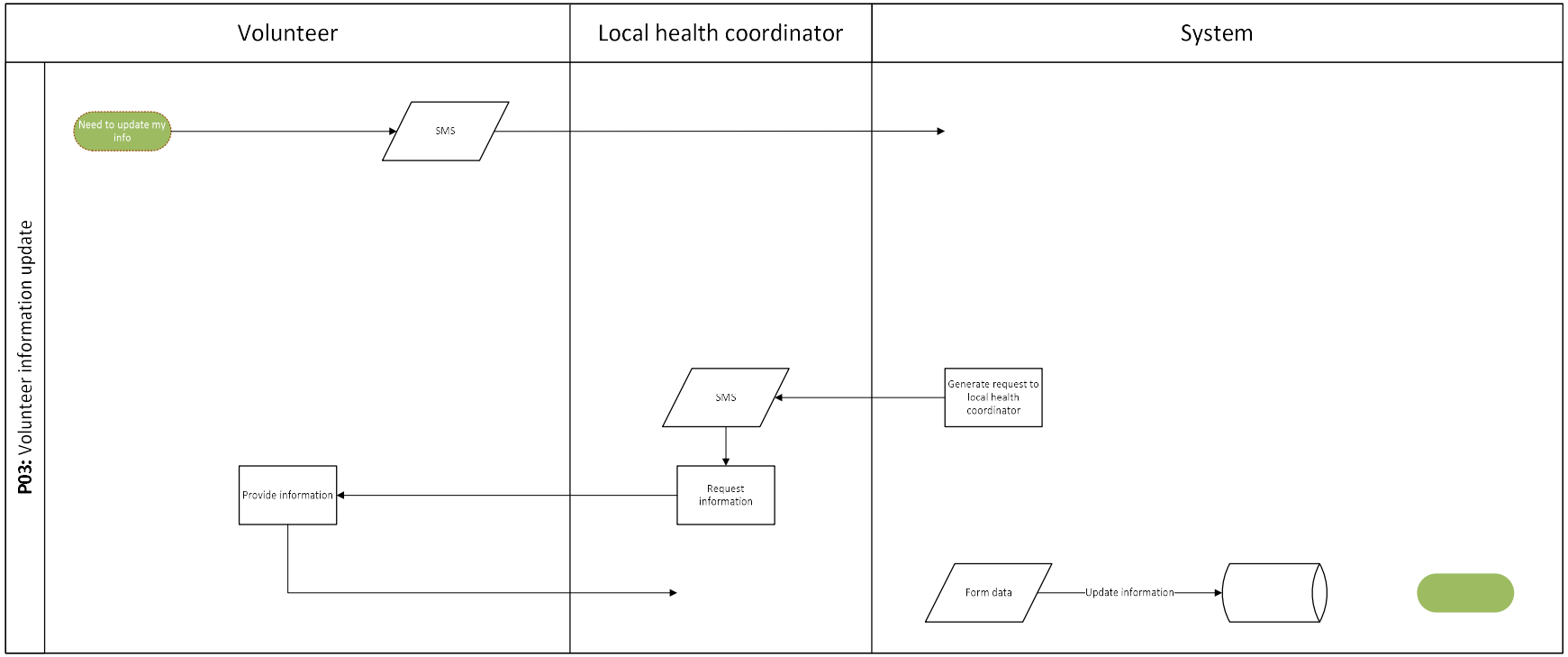


Diagram 3 Volunteer status update (P02)

P03 – Volunteer information update

There are many situation where a volunteer needs to update Red Cross with current information. This would typically be if the volunteer moves to a new location or changes cell phone number. The information provided by the volunteer is what puts the case reports in context (metadata). Incorrect metadata will consequently place the reports in the wrong context, e.g. the wrong location.

User story #	Role	User Story	Functional requirements (system shall…)


Volunteer
Local health coordinator
System
P03: Volunteer information update
Need to update my info
SMS
SMS
Generate request to local health coordinator
Provide information
Request information
Form data
Update information

P04 – Regular feedback

The Red Cross relies heavily on the volunteers to perform their tasks. To improve chances of sustained activity and motivation, the system must interact with the volunteers through regular and ad-hoc feedback. In situations where large outbreaks are on the rise, Red Cross quickly needs to send information to larger groups of volunteers in the affected areas.

User story #	Activity	Role	User Story	Functional requirements (system shall…)
	Blast message volunteers			
	View conversation			
	Send regular feedback to volunteers			

Table 4 Use stories and functional requirements of volunteer registration/manual feedback

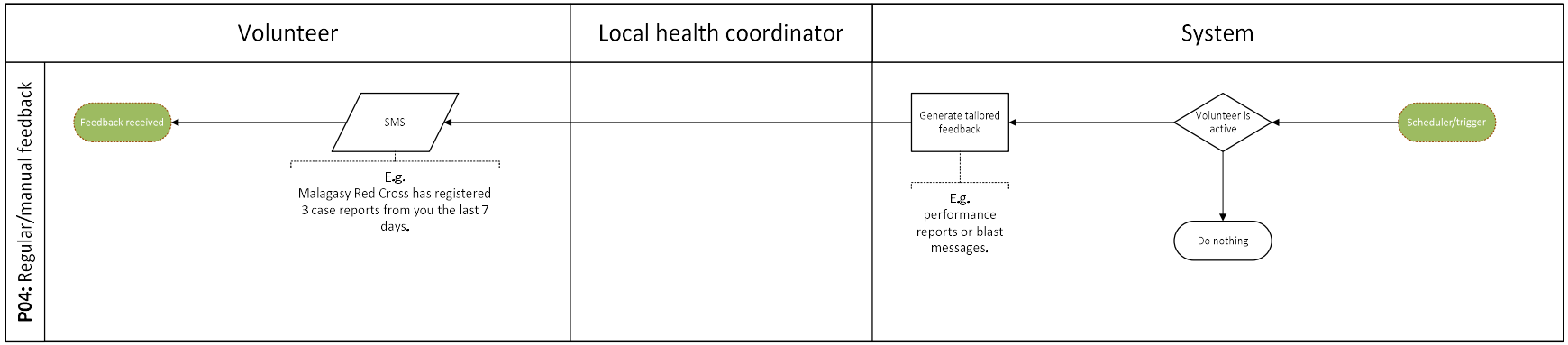


Diagram 5 Regular/manual feedback (P04)

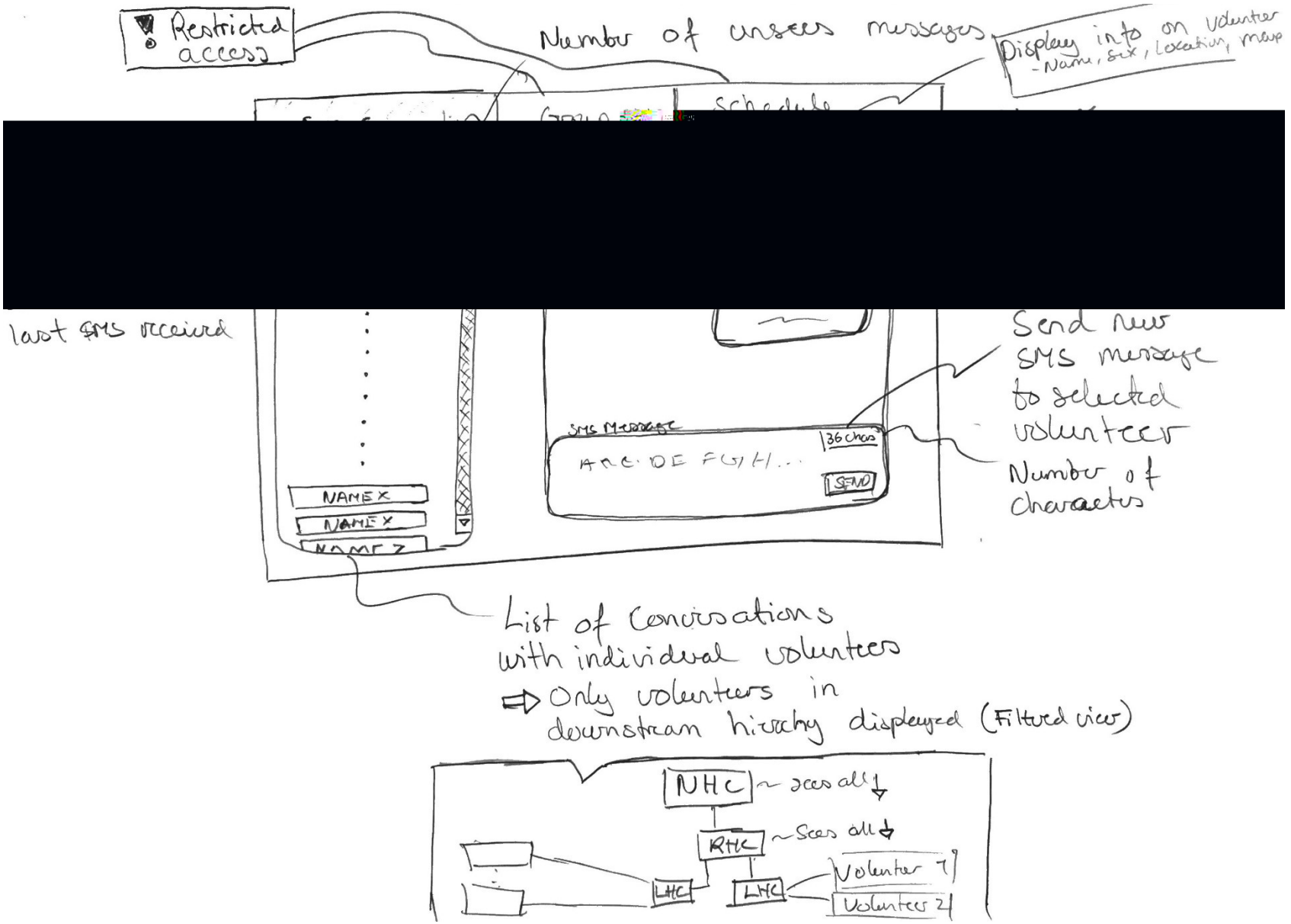


Figure 2 Conceptual mockup of interface for SMS conversations with individual volunteers

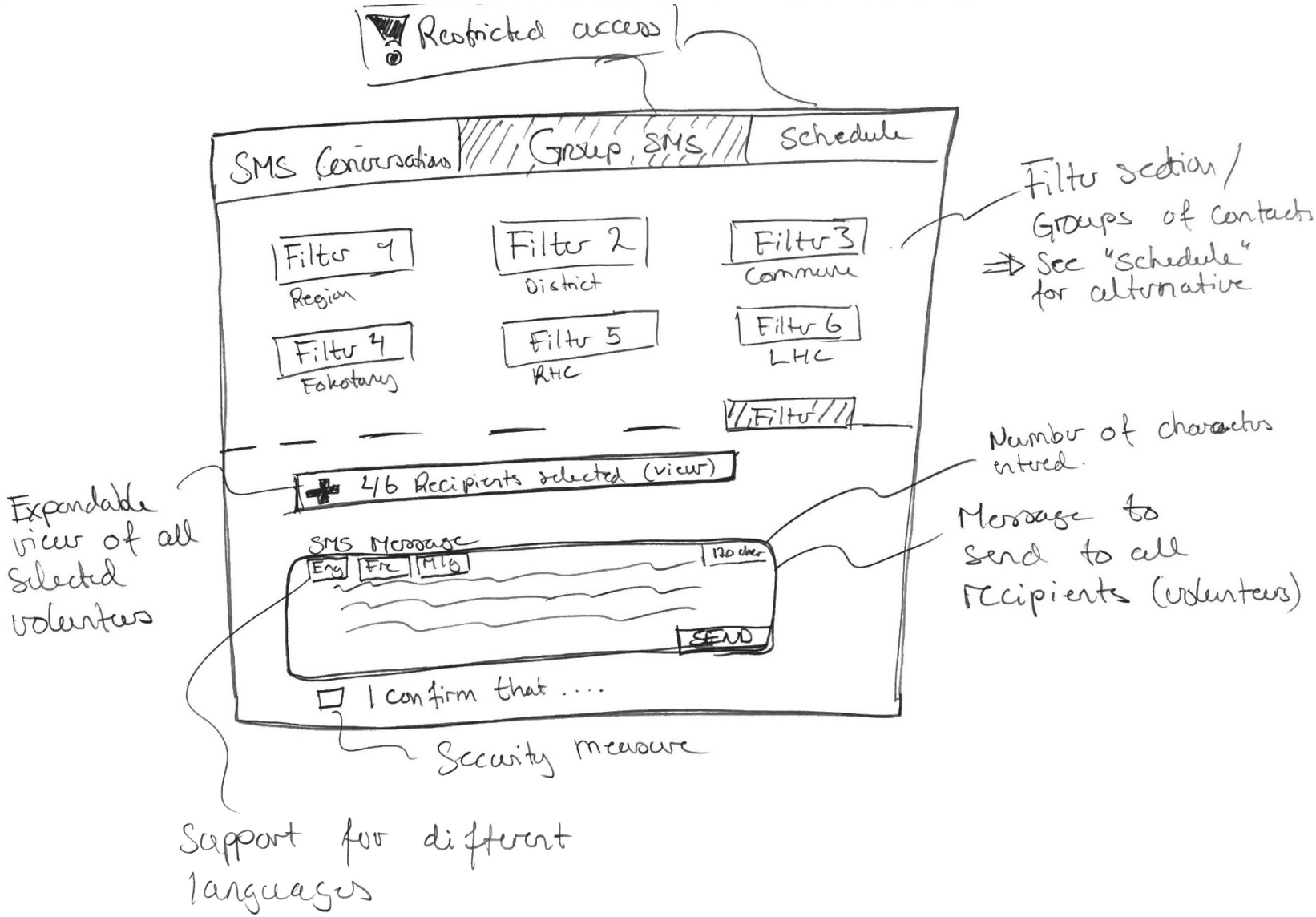


Figure 3 Conceptual mockup of interface for sending custom SMS to groups of volunteers

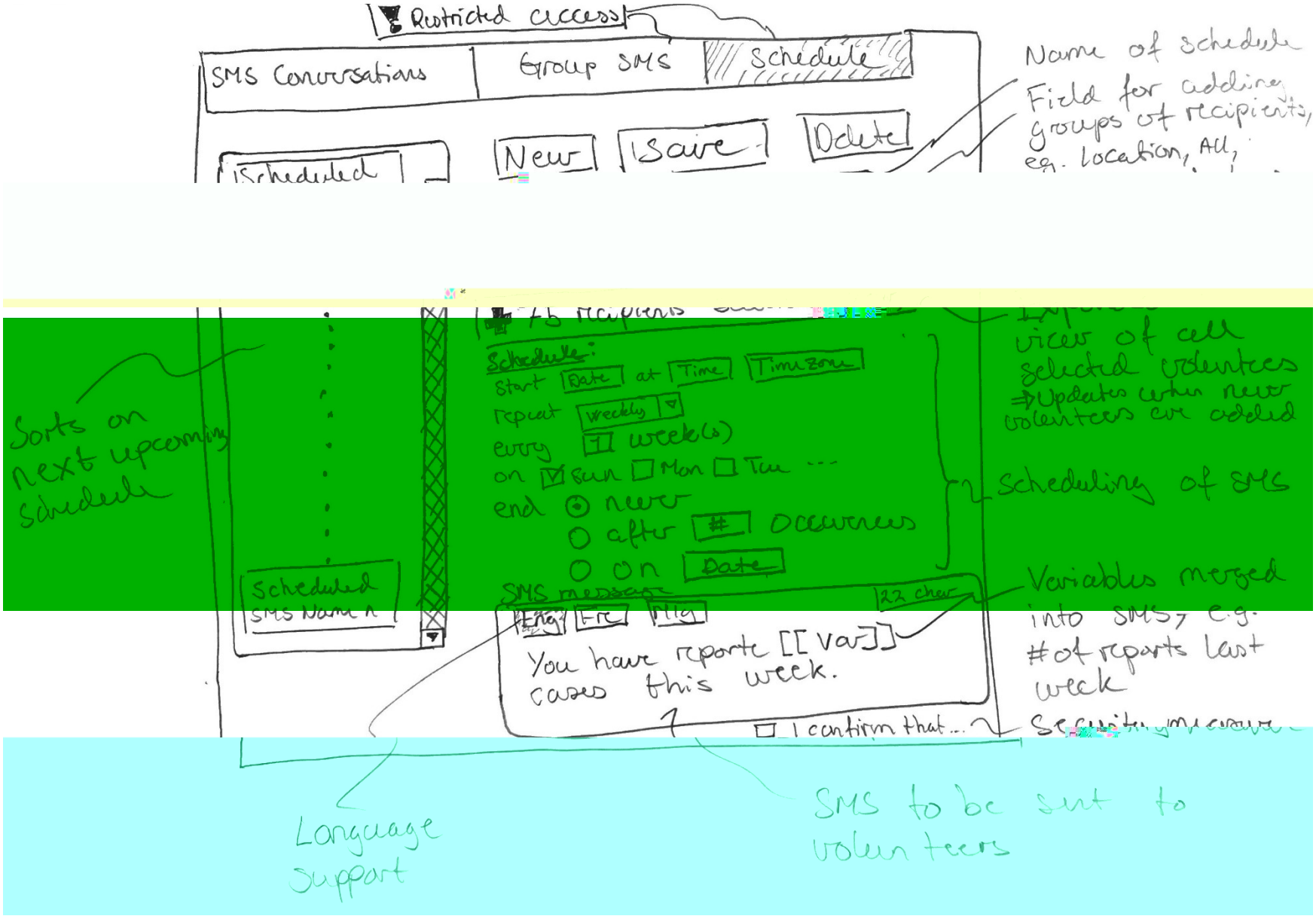


Figure 4 Conceptual mockup of interface for scheduling SMS messages with variables too groups of volunteers

P05 – Volunteer case reporting

The backbone of CBS is the case reporting performed by the volunteers in the field. Elementary to this, is that the data reported is of high quality. The systems must therefore validate the input and provide feedback if the data does not validate when entered. Likewise, it is important to provide feedback if the report does validate so to assure the reporter that the report has been registered and provide information on how to handle the reported case.

User story #	Activity	Role	User Story	Functional requirements (system shall…)
	Report cases			
	Receive confirmation			
	Receive feedback if report is unsuccessful			
	Receive information			

Table 5 Use stories and functional requirements of volunteer case reporting (P05)

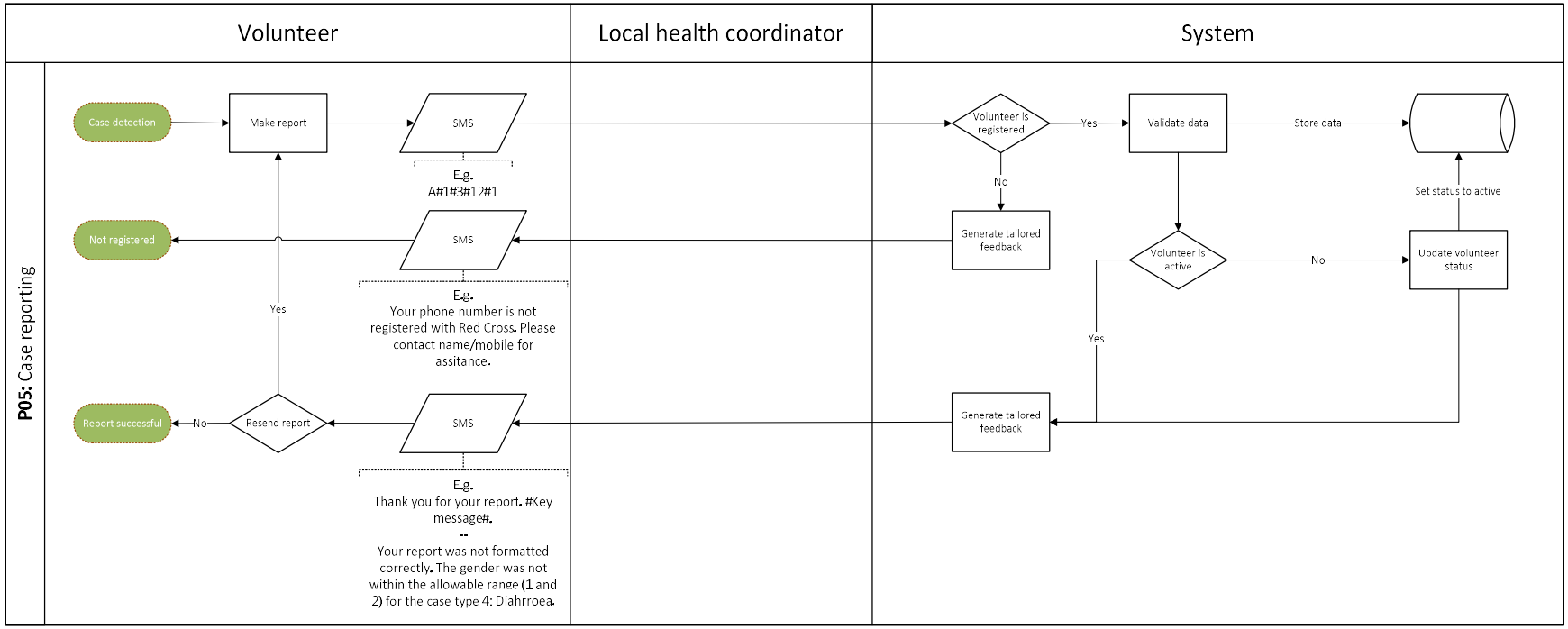


Diagram 6 Case reporting (P05)

P06 – Alert

In the event that a pre-defined business rule issues an alert, a workflow for handling such an alert must be in place. This is necessary both to ensure that all the required actions are taken in multi-alert situations while ensuring data collection in a structure manner. The data collected can be a highly valuable source for post situation analysis and possibly enhancement of prediction models, as well as being a resource for epidemiological research.

User story #	**Activity**	Role	**User Story**	**Functional requirements (system shall…)**
P06.01	Receive a message when an alert is issued	Volunteer	As a volunteer, I want to know if an alert has been triggered based on my reporting, who is responsible to follow up on it and what I should do so that I can know what response to expect and if I should take any actions.	- send an SMS to the volunteers that reported the cases that triggered the alert with information on who has been assigned and a pre-defined message for the type of alert
P06.02	Receive a message when an alert is issued	Local health coordinator	As a local health coordinator, I want to receive alerts immediately so that I know what and where the situation is, who will follow up when and if I need to follow up.	- send an SMS to the LHC with information on what kind of alert has been triggered and at what location
P06.03	Report outcome of investigation	Local health coordinator	As a local health coordinator, I want to receive a link to a pre-filled form in case of alert so that I do not have to spend time on looking them up myself and can concentrate on adding additional details.	- generate a form or reopen an existing (details provided in appendix) with pre-filled information related to the alert - generate a link to the form that opens in the mobile app - send a link to the pre-filled generated to the LHC by SMS
P06.04	Evaluate cases related to the alert	Local health coordinator	As a local health coordinator, I want to have access to each case related to the alert so that I can follow up on every one of them and register if the case was a true or false positive.	- generate a form/entry for each of the cases linked to an alert with a positive/negative confirmation option.
P06.05	Escalate alert to regional health coordinator	Local health coordinator	As a local health coordinator, I want to be able to escalate the alert to the next level so that the regional health coordinator is made aware of the situation.	- provide an option to the LHC to escalate the alert (or not)

User story #	Activity	Role	User Story	Functional requirements (system shall…)
P06.06	Inform volunteer of outcome	Local health coordinator	As a local health coordinator, I want to inform the volunteer about the outcome of my investigation so that they know that we are responding.	- provide a field for the LHC to add a custom message to the volunteers - send an SMS to the volunteers that registered the cases related to the alert with information on the outcome and the customized message from the LHC, if provided
P06.07	Report outcome of investigation	Regional health coordinator	As a regional health coordinator, I want to receive a link to a pre-filled form if the local health coordinator has escalated an alert so that I do not have to spend time on looking them up myself and can concentrate on adding additional details.	- generate a form or reopen an existing (details provided in appendix) with pre-filled information related to the alert - generate a link to the form that opens in the mobile app - send a link to the pre-filled form to the RHC by SMS
P06.08	Evaluate cases related to the alert	Regional health coordinator	As a regional health coordinator, I want to have access to each case related to the alert so that I can follow up on every one of them and register if the case was a true or false positive, given this has not already been registered or if I come to another conclusion.	- generate a form/entry for each of the cases linked to an alert with a positive/negative confirmation option
P06.09	Escalate alert to national health coordinator	Regional health coordinator	As a regional health coordinator, I want to be able to escalate the alert to the next level so that the national health coordinator is made aware of the situation.	- provide an option to the RHC to escalate the alert (or not)
P06.10	Inform volunteer of outcome	Regional health coordinator	As a regional health coordinator, I want to inform the volunteer about the outcome of my investigation so that they know that we are responding.	- provide a field for the RHC to add a custom message to the volunteers - send an SMS to the volunteers that registered the cases related to the alert with information on the outcome and the customized message from the RHC, if provided
P06.11	Inform local health coordinator of outcome	Regional health coordinator	As a regional health coordinator, I want to inform the local health coordinator about the outcome of my investigation so that they know that we are responding.	- provide a field for the RHC to add a custom message to the LHC - send an SMS to the LHC that escalated the alert with information on the outcome and the customized message from the RHC, if provided

User story #	Activity	Role	User Story	Functional requirements (system shall…)
P06.12	Report outcome of investigation	National health coordinator	As a national health coordinator, I want to receive a link to a pre-filled form if the regional health coordinator has escalated an alert so that I do not have to spend time on looking them up myself and can concentrate on adding additional details.	- generate a form or reopen an existing (details provided in appendix) with pre-filled information related to the alert - generate a link to the form that opens in the mobile app - send a link to the pre-filled form to the NHC by SMS
P06.13	Evaluate cases related to the alert	National health coordinator	As a national health coordinator, I want to follow up on each case related to the alert and register if the case was real or a false positive given this has not already been registered or if I conclude differently.	- generate a form/entry for each of the cases linked to an alert with a positive/false/unconfirmed confirmation option
P06.14	Inform volunteer of outcome	National health coordinator	As a national health coordinator, I want to inform the volunteer about the outcome of my investigation so that they know that we are responding.	- provide a field for the NHC to add a custom message to the volunteers - send an SMS to the volunteers that registered the cases related to the alert with information on the outcome and the customized message from the NHC, if provided
P06.15	Inform local health coordinator of outcome	National health coordinator	As a national health coordinator, I want to inform the local health coordinator about the outcome of my investigation so that they know that we are responding.	- provide a field for the NHC to add a custom message to the LHC - send an SMS to the LHC that escalated the alert with information on the outcome and the customized message from the RHC, if provided
P06.16	Inform regional health coordinator of outcome	National health coordinator	As a national health coordinator, I want to inform the regional health coordinator about the outcome of my investigation so that they know that we are responding.	- provide a field for the NHC to add a custom message to the RHC - send an SMS to the RHC that escalated the alert with information on the outcome and the customized message from the NHC, if provided

Table 6 Use stories and functional requirements of alert workflow

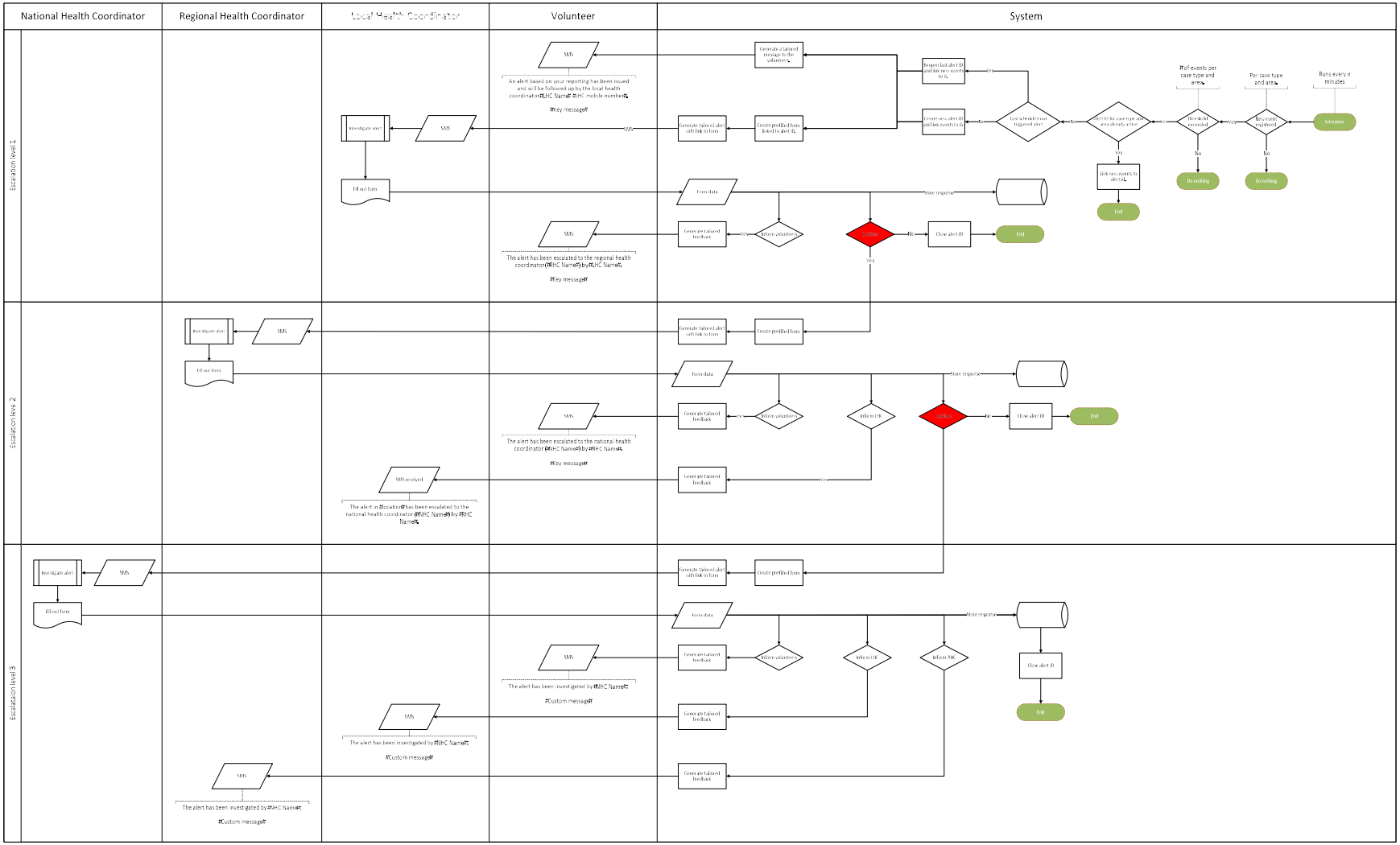


Diagram 7 Alert workflow (P06)

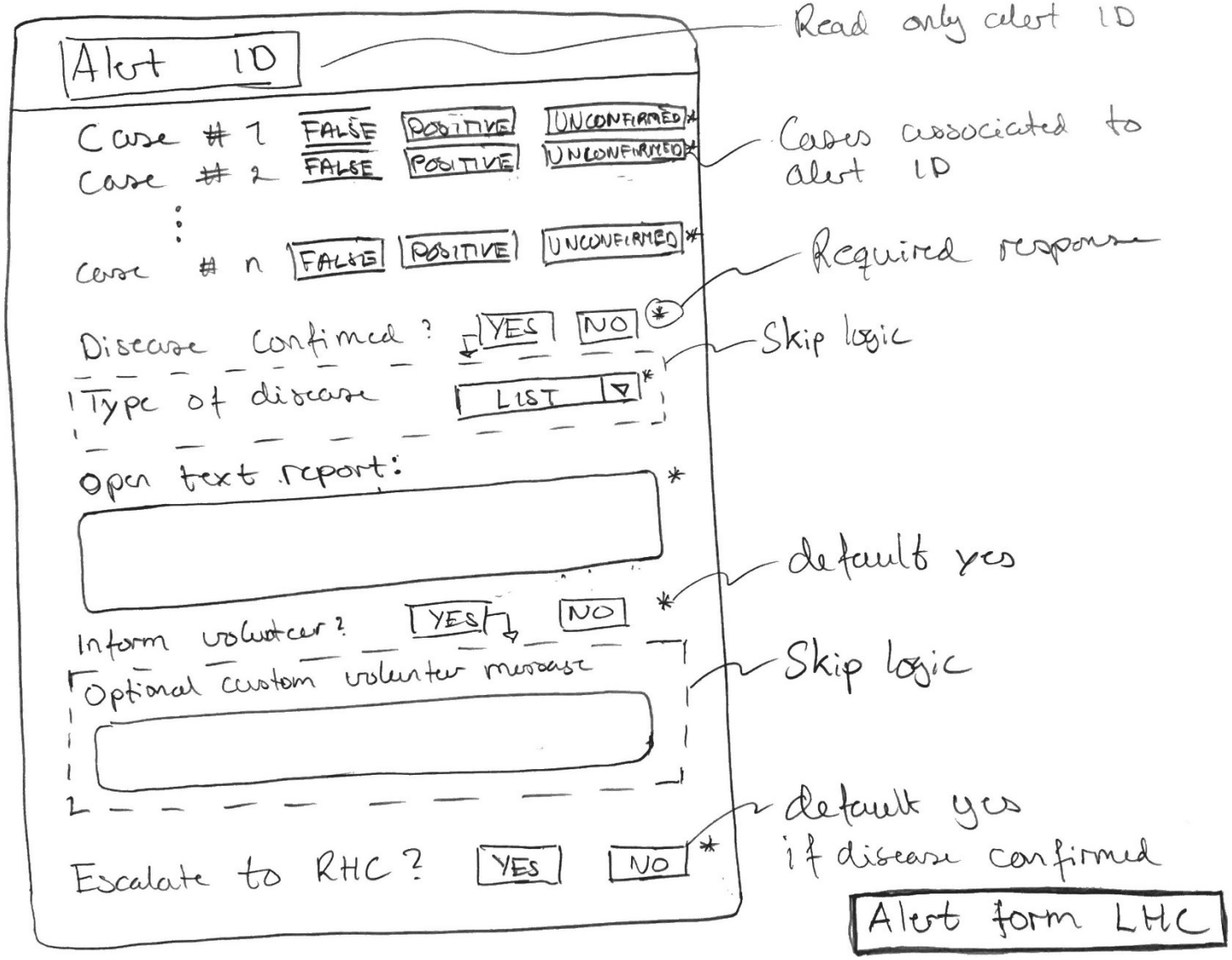


Figure 5 Conceptual mockup of alert form

P07 – Reporting

Reporting is the process of transforming data into actionable intelligence and serves as an important part of the surveillance and response mechanisms in CBS. The reports outlined in this section describes additional reports to CBS version 1.

User story #	Activity	Role	User Story	Functional requirements (system shall…)
P07.01	**Overlay GIS-data on situational map**	National health coordinator	As a national health coordinator, I want to overlay 3rd party GIS-data such as weather and hospitals on my situation map so that I can take decisions that are more informed.	- have mapping technology that can overlay 3rd party GIS-data
P07.02	**Situational intelligence**	National health coordinator	As a national health coordinator, I want to have an overview of ongoing alerts with contact information to the response team so that I can follow up with them directly.	- provide a report or dashboard with contact information to the individuals responding to an alert
P07.03	**Ongoing and historic alerts**	National health coordinator	As a national health coordinator, I want to have an overview of all active and historic alerts with status and outcome so that I can get a sense of the overall situation and how we are responding.	- provide a report or dashboard displaying all ongoing and historic alerts with corresponding outcome status and information on investigations and cases related to the alerts
P07.04	**Have an overview of false alert trends**	National health coordinator	As a national health coordinator, I want to have an overview of false alerts so that I can understand if the alert definition has the correct sensitivity.	- provide a report with details on alerts confirmed to false positives
P07.05	**Surveillance coverage**	National health coordinator	As a national health coordinator, I want to know how many volunteers are active and in what area so that we can focus our recruiting efforts on areas lacking surveillance coverage.	- provide a report displaying active volunteers
P07.06	**Passive volunteer follow up**	National health coordinator	As a national health coordinator, I want to know what volunteers are passive so that I can follow up on why they are passive.	- provide a report displaying volunteers with status passive and volunteers that have not sent reports for a user defined number of days
P07.07	**Share intelligence with authorities**	National health coordinator	As a national health coordinator, I want to send a weekly report of trends, alerts and outcomes to the national health authority so that we are transparent and builds trust.	- provide an export functionality to PDF of reports

Table 7 Use stories and functional requirements of reporting

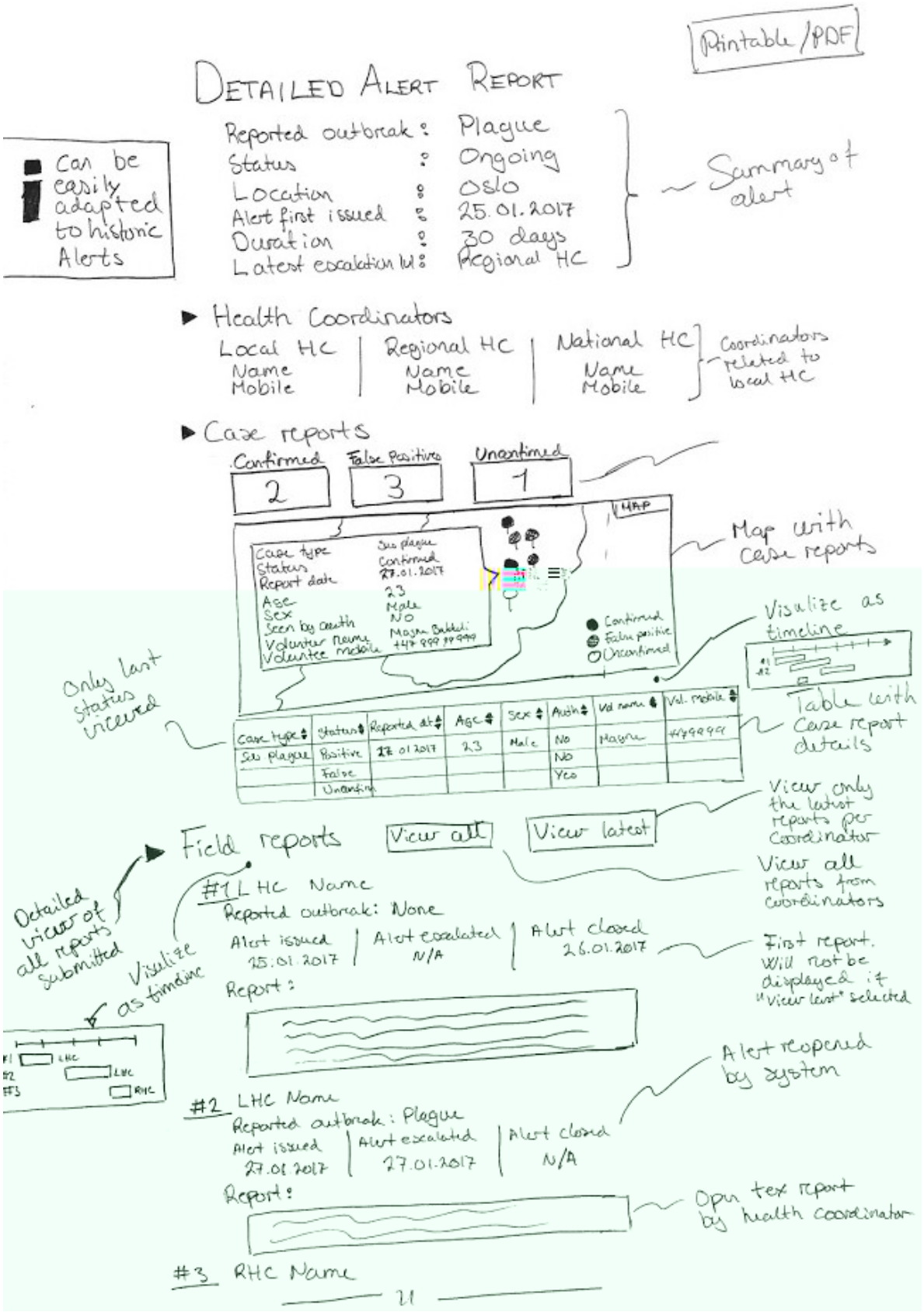


Figure 6 Conceptual mockup of detailed report of ongoing/historic alerts

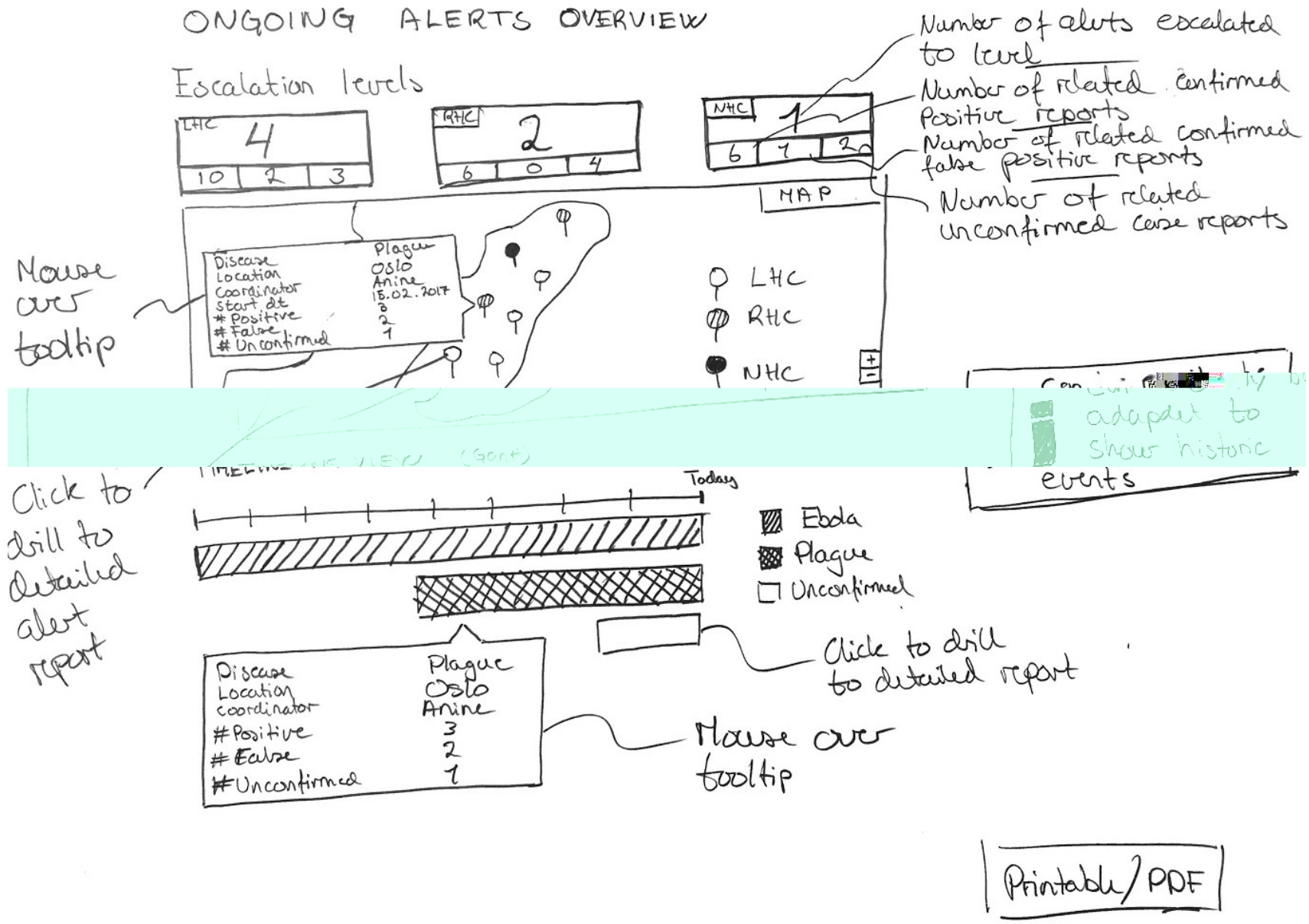


Figure 7 Conceptual mockup of report overviewing ongoing/historic alerts

P08 – Configure alert definitions

User story #	Activity	Role	User Story	Functional requirements (system shall…)
	Alter alert definitions			

Table 8 Use stories and functional requirements of configuration of alert definitions

P09 – User access and Identity Management

User story #	Activity	Role	User Story	Functional requirements (system shall…)
	User access management			

Table 9 Use stories and functional requirements of user access and identity management

P10 – System monitoring

User story #	Activity	Role	User Story	Functional requirements (system shall…)
	System monitoring			

Table 10 Use stories and functional requirements of system monitoring

Non-functional requirements

Security

- Secured against unauthorized access to both the different components and the data flows between them.
- Configurable with different access levels per user and role.
- Data collection, processing and use shall adhere to relevant data protection laws and legal guidelines for the collected data.
- Data flows and storage shall be logically separated per deployment.

Performance

- Outbound/inbound SMS rate 1500 per hour per deployment/gateway.
- Flexible system resource management scalable to multi-site deployments.

Integrity

- All response forms must validate user input real time.
- Pre-populated fields should be used wherever possible, e.g. geographic location
- The data model should reflect the historic status at any given point in time, e.g. store changes in volunteer GPS location.
- The data collected has to be linked by keys, so that it is ready for analysis. E.g. the recorded response from the local health coordinator when an alert is issued, must be connected to the volunteer reports that issued the alert.

Usability

- User-friendly ("nurse compatible") user interfaces for reporting and data collection.
- Multilingual support in all communication and user interfaces, configurable per deployment.

Recovery

- All data should be backed up daily and stored for 30 days.

Documentation

- System and detailed technical documentation for CBS technical staff.
- High-level user documentation for CBS non-technical staff.

Deployment

- Inbound and outbound SMS-messages must relayed through the same local mobile telephone number.
- The cost of sending SMS to the system must be zero.
- The system must be deployable to locations with unreliable internet connectivity.

High-level system requirements

Components

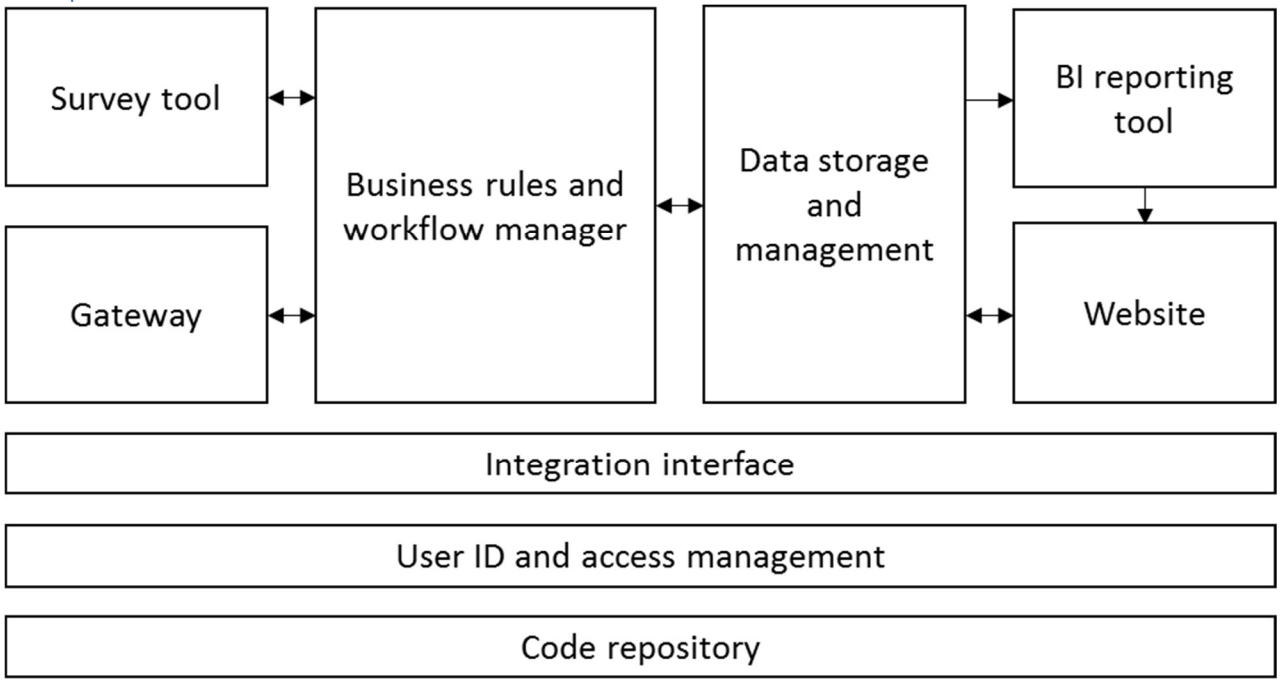


Figure 8 High-level overview of required system components

In order to support the full list of functional and non-functional requirements, the solution will have to implement and integrate multiple components. Figure 8 gives a high-level overview of these components, illustrated with conceptual flow of data.

Some of the components and/or integrations might have to be developed in-house (using available open source systems/libraries where available), while most of the functionality may be derived from third party apps connected through an integration interface backend.

Component	Examples	Functionality	Conceptual integration
Survey tool	Fulcrum App Device Magic Formitize Zegeba	• Design and administer forms. • Collect data from health coordinators.	Business rules and workflow manager
Gateway	Telerivet SMSSync Twilio (virtual) Nexamo (virtual) Local network operator	• Local mobile phone number for volunteers to send SMS too. • Local/short code/international phone number for the system to send SMS to volunteers and health coordinators.	Business rules and workflow

Component	Examples	Functionality	Conceptual integration
Business rules and workflow manager	Azure functions Fulcrum App Telerivet	• Manage, store and apply business rules, e.g. report validations, alert triggering and case report-alert linkage, on data and system events. • Actuate a series of events defined as a workflow, e.g. on alerts.	Data storage and management
Data storage and management	SQL Server	• Historic storage of records • Data model for reporting • Rule parameters • Multi lingual SMS-text • User credential storage	Administration console on website, BI tool, business rules and workflow
BI Reporting Tool	Power BI	• Author and host reports	Data storage and management, website, mobile app
Website	N/A	• Public website • Access restricted website with embedded reports and administration interface for rule parameters and multilingual SMS text message definitions.	Data storage and management, BI tool
Integration interface	Azure Service Bus	• Integrate with third party APIs	
User ID and access management	Azure AD Directory In app locally managed	• Manage user access	
Code repository	GitHub Microsoft Team Services	• Host and version control code	

Table 11 High-level overview of required system components

Data model

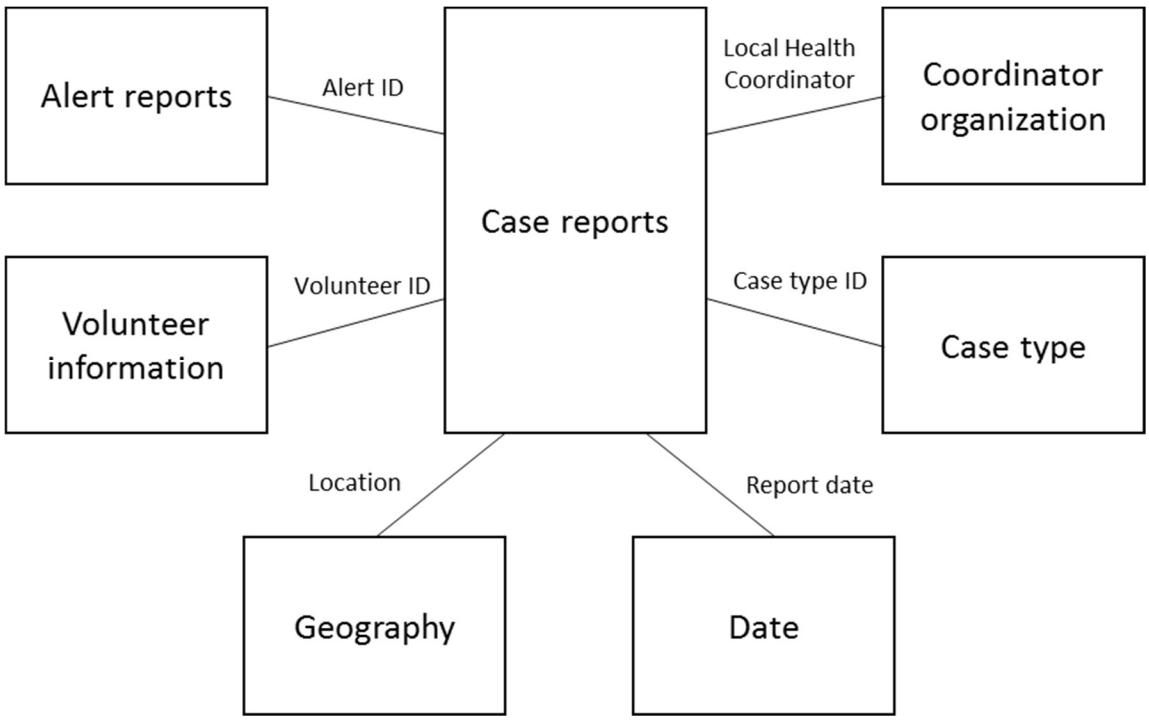


Figure 9 High-level data model for reporting

In order to simplify the development of reports, the system should structure data in a robust dimensional model on the database. This strategy also ensures that any business logic implemented on the raw data is placed in one central location, ensuring correctness in all connected reports if errors are corrected at a later stage.

Appendix A – Trigger rules for alerts

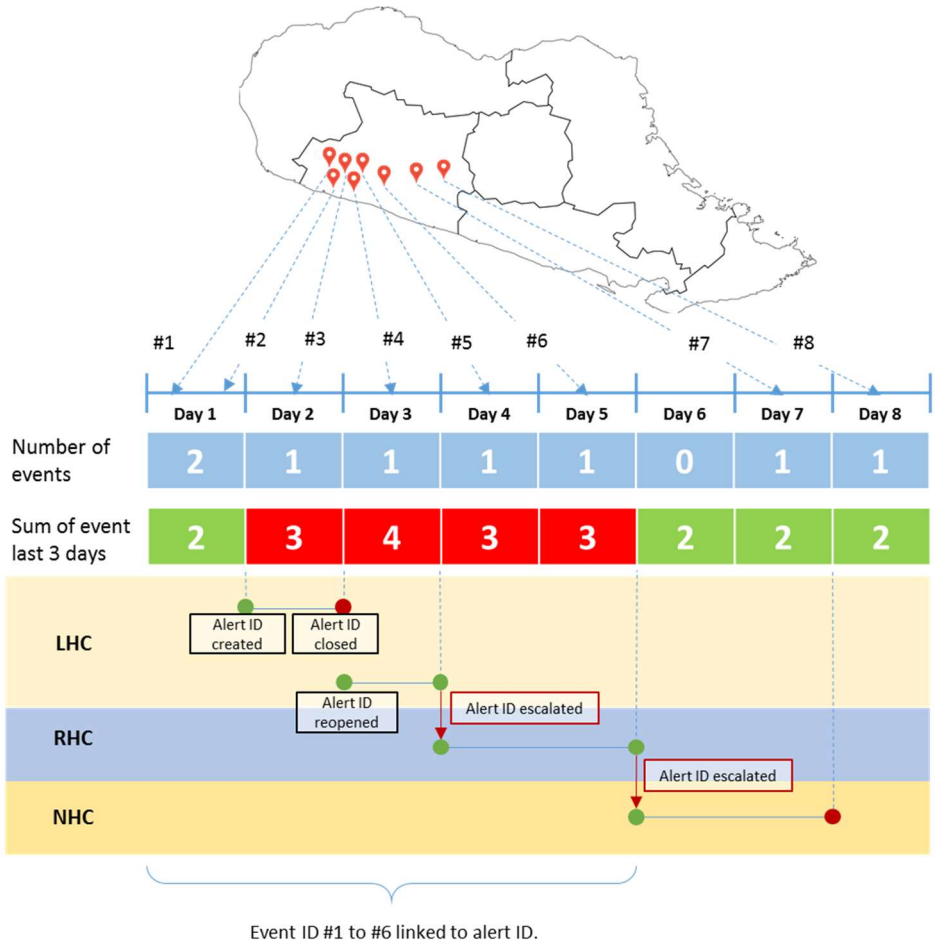


Figure 10 Illustration of hypothetical alert workflow and case report linking to alert IDs

Hypothetical scenario

Day 1

Day 2

Day 3

Day 4 and 5

Day 6 and 7

not

Day 8

Appendix B – As-is diagram

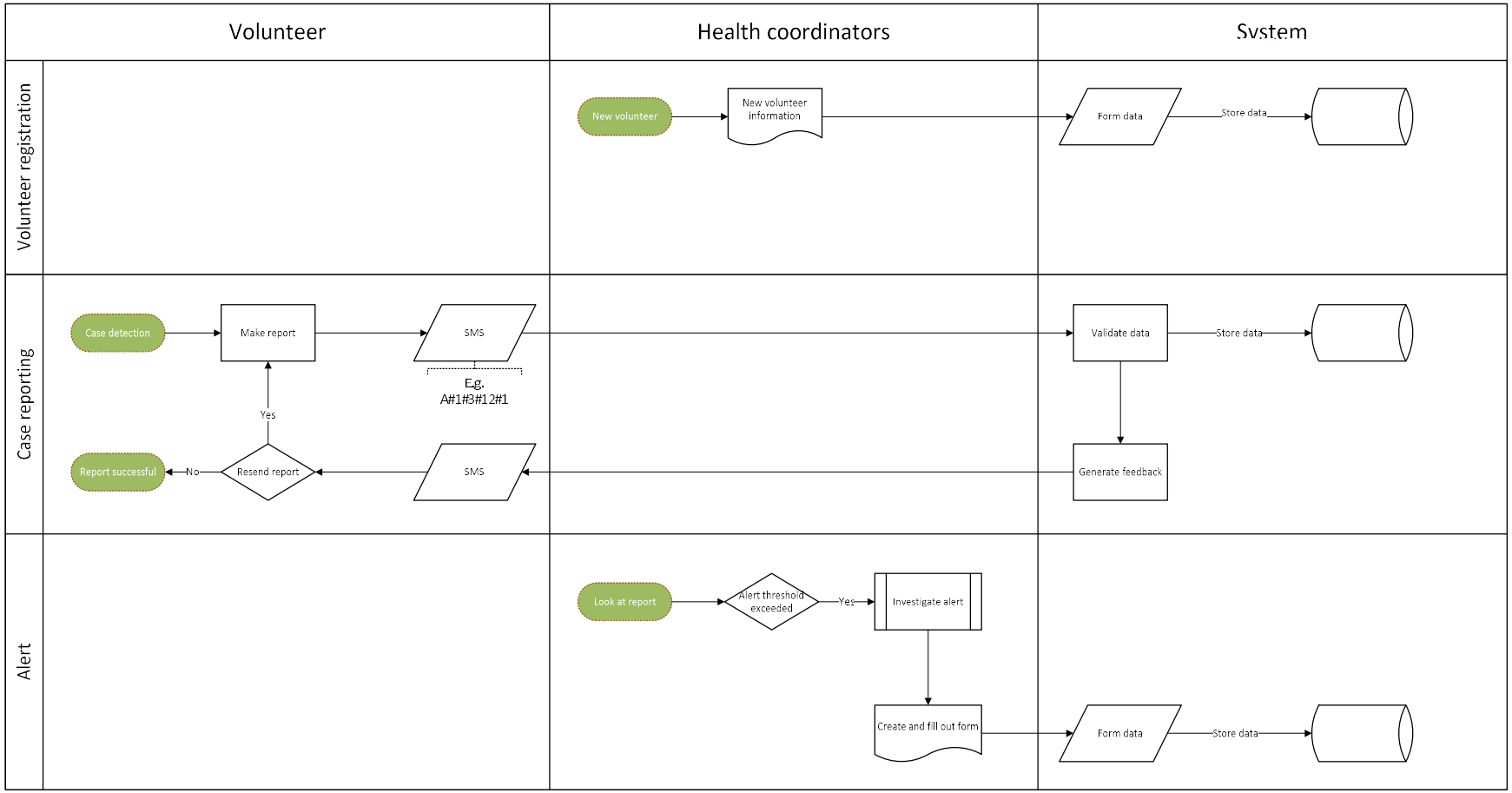


Diagram 8 As-is diagram of pilot in Madagasca