INSTRUCTIONS ON USING
ARGUS IN NATIONAL
PUBLIC HEALTH SURVEILLANCE

GO FURTHER IN PUBLIC HEALTH PROTECTION

CONTENTS

1. INTRODUCTION

▶ 1.1 EARLY DETECTION AND RESPONSE IN RESOURCE-LIMITED SETTINGS

Early detection and response to public health events such as infectious disease outbreaks are key to reducing their propagation and impact. In resource-limited settings, paper-based transmission is the traditional way of reporting public health surveillance data. Due to lack of resources and infrastructure, this leads to difficulties in routinely analysing data and to important delays for the early detection of a public health event.

To overcome these challenges, electronic data management systems using computers and the internet have been piloted in several countries to provide faster data collection and data analysis. Yet, in most resource-limited settings, these systems are restricted to intermediate and central levels due to the lack of infrastructure and data connectivity at the peripheral level. In the last decade, there has been a striking development of mobile phone infrastructure in resource-limited settings, including in hard to reach areas. This creates new possibilities for electronic management of public health surveillance data at all levels.

▶ 1.2 ARGUS IT TOOL

The World Health Organization (WHO) has developed Argus, an open source IT tool to support public health surveillance for early detection and response. It uses Short Message Service (SMS) technology for the transmission of information between the local healthcare facilities and all levels of the public health surveillance system via a mobile application *(Figure 1)*. A web platform complements the application for data management and analysis *(Figure 2)*.
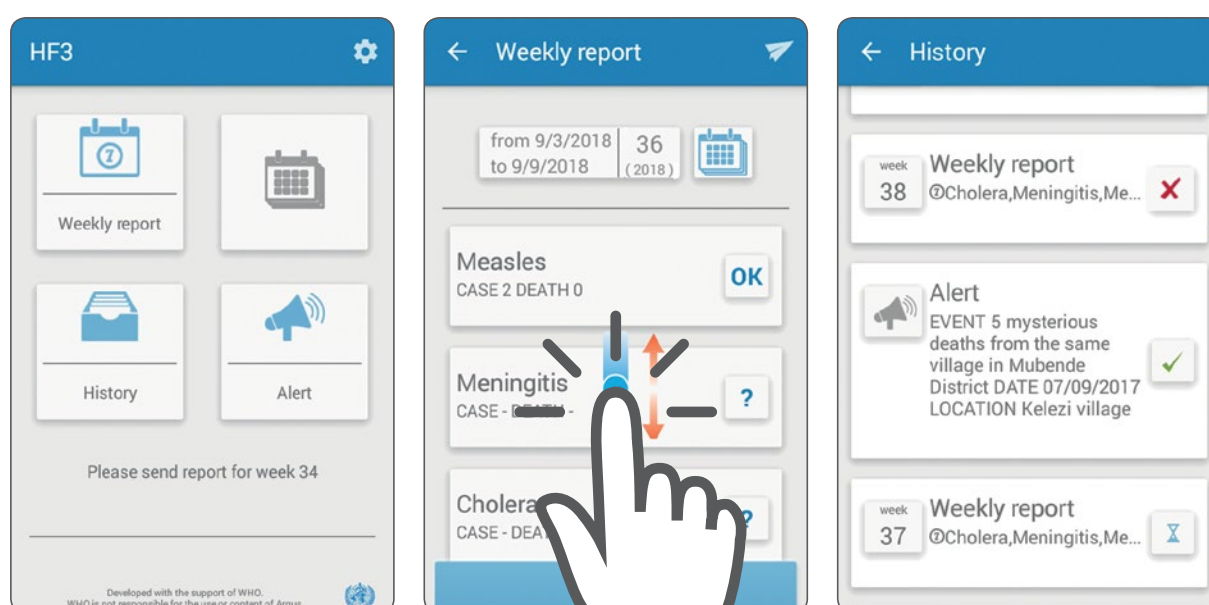

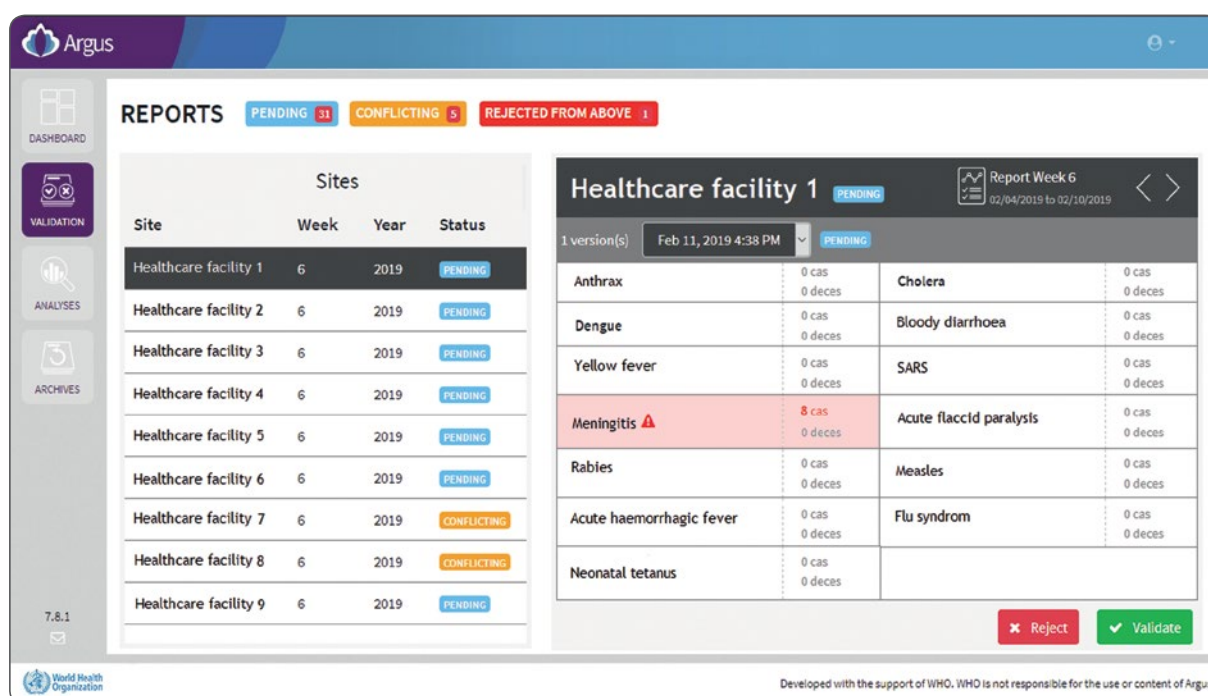*Figure 1.* **Argus application for Android phones**

Figure 2. Argus web platform

Argus improves routine reporting quality and speed by reducing dependency on paper forms. It allows administrators to easily set up the public health events to be under surveillance, the variables to be collected, and the different levels of the public health surveillance system in charge of data validation and data analysis.

Argus is mainly designed to manage aggregated **weekly reports** of priority public health events. It also manages aggregated **monthly reports** of public health events, and **alerts** of unexpected public health events.

For its users, Argus has two main components:

- An **application for Android phones** to send public health surveillance data by SMS in a simple manner.
- A **web platform** to collect, analyse, and monitor the data sent by SMS.

In practice, a central server located in the country collects the data sent by the healthcare facilities through SMS. The central server returns SMS to the healthcare facilities to acknowledge the reception of the data and posts the information on the internet through the Argus web platform for data management and analysis. *Figure 3* illustrates the overall structure of Argus.

Argus aims to facilitate the **collection, transmission and management of public health surveillance data** in respect to the Integrated Surveillance and Response (IDSR) technical guidelines and the WHO Regional Office for Africa public health surveillance strategy by offering an IT solution to achieve several IDSR specific objectives:

- Improve the flow of public health surveillance information between the different levels of the health system.
- Improve the use of information to quickly detect changes in order to conduct a rapid response to suspect outbreaks.
- Strengthen the capacities of countries to conduct effective public health surveillance activities.

USE OF THE ARGUS IT TOOL FOR PUBLIC HEALTH SURVEILLANCE

MOBILE PHONE OPERATOR
- forward the SMS between the healthcare facilities and the Argus central server

CENTRAL SERVER - ARGUS
- collection and aggregation of data
- data visualization, validation, analysis
- automatic weekly epidemiological summaries

SMS

SMS   **SMS**

ARGUS CENTRAL SERVER

Login
Username
Password

Argus

WEB PLATFORM
- data validation
- data analysis and monitoring
- export of data

HEALTHCARE FACILITIES
- send weekly and monthly reports
- send alerts
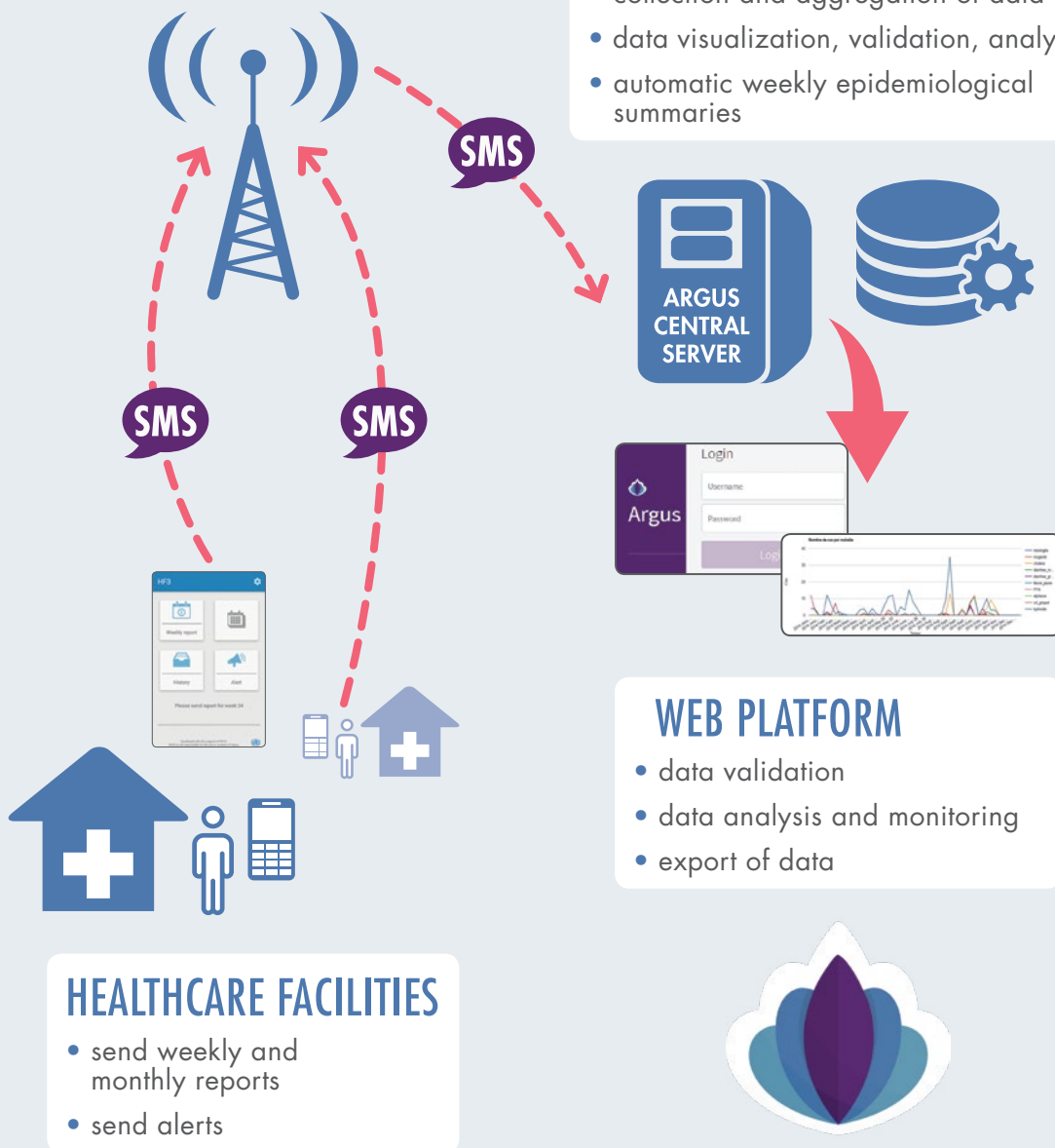
Figure 3. **Overall structure of Argus**

▶ 1.3 ARGUS IMPLEMENTATION TOOLBOX

The Argus Implementation Toolbox provides the necessary guidance and tools for setting up Argus in a country. Its objective is to allow countries to implement Argus autonomously to strengthen their national public health surveillance system.

The Argus Implementation Toolbox consists of the present **instruction document** on how to set-up Argus for national public health surveillance and several companion kits:

- **an installation kit**;
- **a training kit** with material for training workshops; and
- **an evaluation kit** with detailed indicators for evaluation and templates for individual questionnaires and focus groups.

The different sections of the instruction document and the related toolkits are presented in *Figure 4*.

Figure 4. Argus Toolbox: instruction document and related toolkits

2. CONDITIONS FOR ARGUS IMPLEMENTATION

Before implementing Argus, countries wishing to strengthen their capacities for public health surveillance should decide whether or not Argus is an appropriate tool to fulfil their needs. Argus aims to support routine reporting from healthcare facilities via an Android application and data validation and analysis by e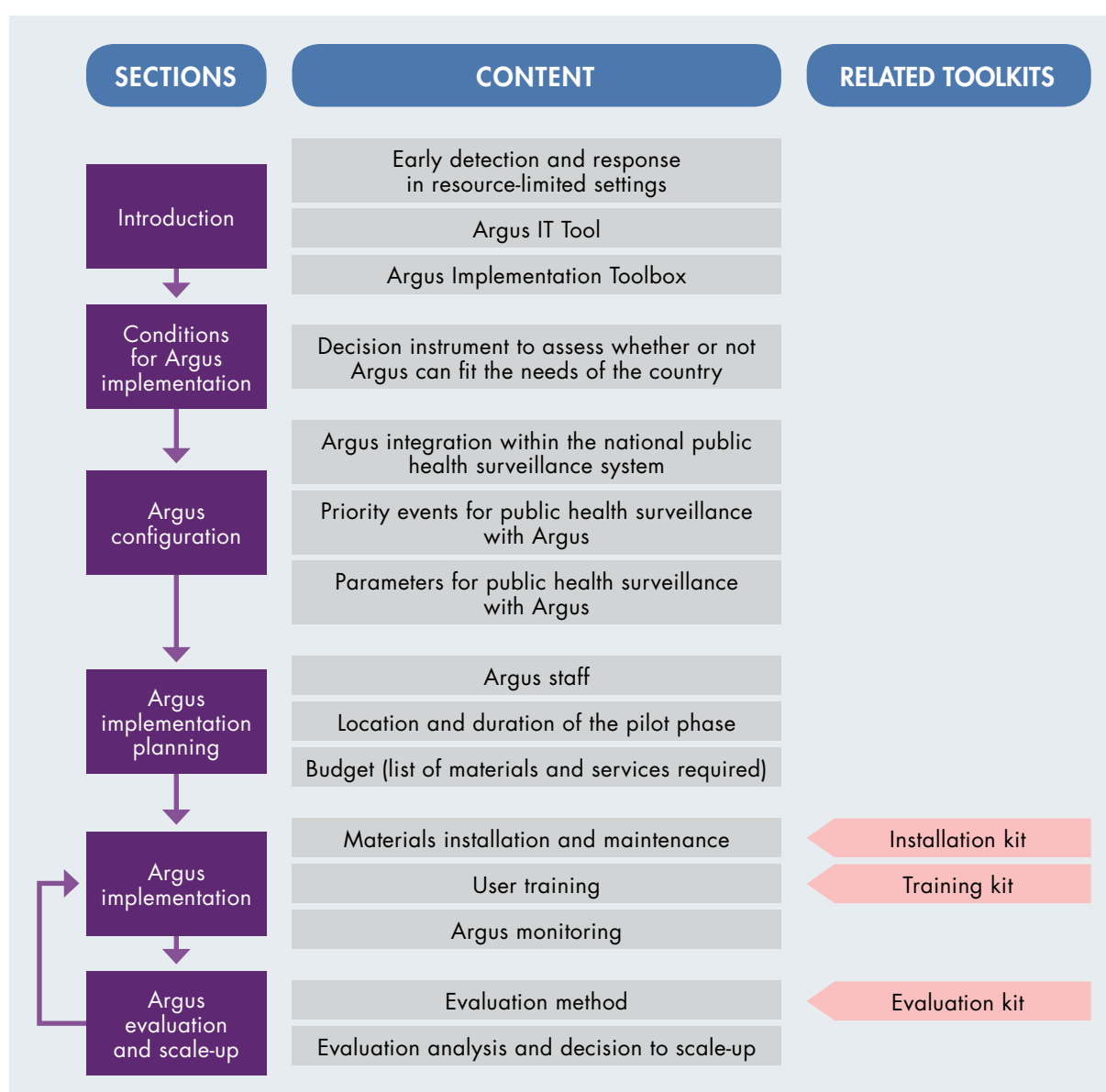ach level of the national public health surveillance system (NPHSS) via a web platform. The decision instrument presented in *Figure 5* can help assess whether or not Argus is an appropriate tool in the context of the country.
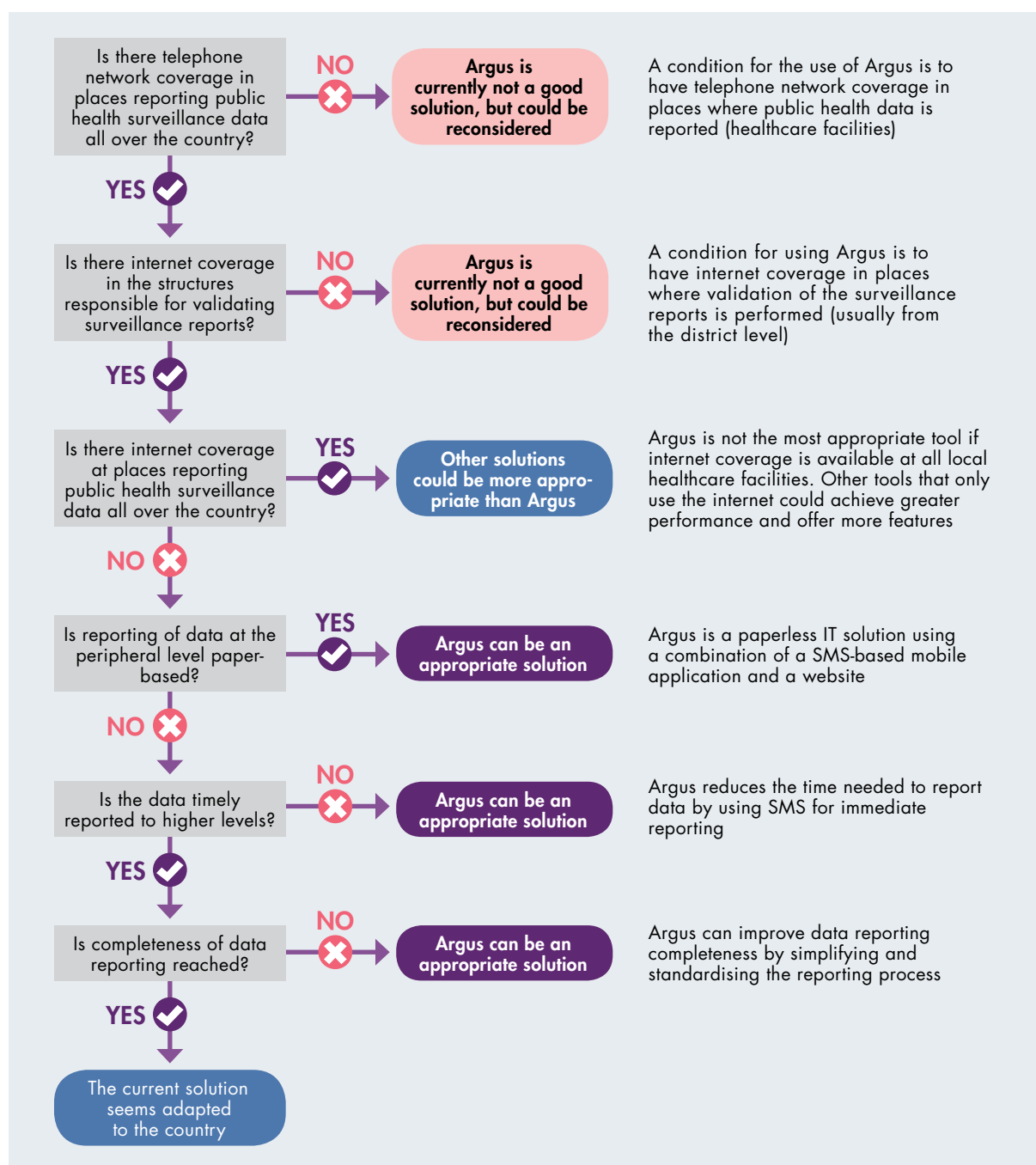
```
Is there telephone          NO      Argus is          A condition for the use of Argus is to
network coverage in        ──X──►   currently not a   have telephone network coverage in
places reporting public             good solution,    places where public health data is
health surveillance data            but could be      reported (healthcare facilities)
all over the country?               reconsidered
        │
      YES ✓
        ▼
Is there internet coverage  NO      Argus is          A condition for using Argus is to
in the structures          ──X──►   currently not a   have internet coverage in places
responsible for validating          good solution,    where validation of the surveillance
surveillance reports?               but could be      reports is performed (usually from
                                    reconsidered      the district level)
        │
      YES ✓
        ▼
Is there internet coverage  YES     Other solutions   Argus is not the most appropriate tool if
at places reporting        ──✓──►   could be more     internet coverage is available at all local
public health surveillance          appropriate       healthcare facilities. Other tools that only
data all over the country?          than Argus        use the internet could achieve greater
                                                       performance and offer more features
        │
      NO ✗
        ▼
Is reporting of data at the YES     Argus can be an   Argus is a paperless IT solution using
peripheral level paper-    ──✓──►   appropriate       a combination of a SMS-based mobile
based?                              solution          application and a website
        │
      NO ✗
        ▼
Is the data timely          NO      Argus can be an   Argus reduces the time needed to report
reported to higher levels? ──X──►   appropriate       data by using SMS for immediate
                                    solution          reporting
        │
      YES ✓
        ▼
Is completeness of data     NO      Argus can be an   Argus can improve data reporting
reporting reached?         ──X──►   appropriate       completeness by simplifying and
                                    solution          standardising the reporting process
        │
      YES ✓
        ▼
The current solution
seems adapted
to the country
```

Figure 5. Decision instrument to assess whether or not Argus can fit the needs of the country

3. ARGUS CONFIGURATION

As a first step for Argus implementation, Argus needs to be set up according to the national context. It should be integrated within the NPHSS and several parameters have to be defined. An example of Argus configuration is presented in *Figure 6*.

▶ 3.1 ARGUS INTEGRATION WITHIN THE NATIONAL PUBLIC HEALTH SURVEILLANCE SYSTEM

Prior to Argus implementation, a quick analysis of the current situation of the NPHSS is needed to identify all relevant elements for a successful integration of Argus to the existing system. In particular:

- the use of an electronic solution for the health management information system (HMIS); and
- the existence of duplicated channels to report for specific diseases.

The successful implementation of Argus relies on the interoperability between existing electronic tools used for public health data and on the integration of the different reporting channels if they are currently fragmented.

Another essential element for a successful Argus implementation is to involve all relevant stakeholders in the project. A stakeholder analysis can be a useful preliminary step to identify key stakeholders directly or indirectly affected by the issue of public health surveillance and whose actions may have consequences on the project. It may be useful to create a stakeholder group including representatives of the different levels of the NPHSS along with other key stakeholders such as other ministries, non-governmental organizations, and private institutions. This group could provide guidance during the preparation, implementation, and evaluation phases of the project.

▶ 3.2 PRIORITY EVENTS FOR PUBLIC HEALTH SURVEILLANCE WITH ARGUS

A step prior to Argus implementation is to set up a list of priority events for public health surveillance. Even if such a list already exists, it is recommended that countries review their national priorities for public health surveillance periodically to determine whether or not it reflects current needs. The implementation of Argus to strengthen national public health surveillance is a good opportunity to do so.

Public health surveillance can involve data collection and data reporting at different frequencies for different purposes:

- **immediate reporting** of case based information allows for early warning of unexpected or highly pathogenic/lethal public health events;
- **weekly aggregated reporting** provides data for monitoring trends of diseases, conditions or events to early detect outbreaks; and
- **monthly aggregated reporting** provides data for monitoring the health status of the population and impact of disease specific programs, and for planning allocation of resources.

Argus was mainly designed for **early detection of outbreaks via weekly aggregated reporting** of priority public health events. Public health events that should be reported weekly are only conditions that can be identified by healthcare workers at peripheral facilities, and that require early investigation and response (epidemic-prone diseases mainly). A minimum of data to be collected (number of cases and deaths for example) is enough to trigger the required investigation.

The list of priority public health events to be reported by healthcare facilities should be established by a group of relevant stakeholders from, and related to, the NPHSS. The list of public health events will vary from country to country depending on the local epidemiological situation and resources available.

Several methodologies can be used to prioritize risks and establish a list of priority public health events. The European Centre for Disease Prevention and Control has performed a literature review on best practices in ranking communicable disease threats that can be consulted to carry out a risk prioritization workshop[1].

⚠️ **To make the best use of limited human and financial resources for public health surveillance, countries are strongly advised to keep the list of events to be reported to a minimum to ensure that it is manageable by the system and that adequate resources are available to carry out a response. Only events which could result in public health action (e.g. investigation, response) should be on the list. Some rare but high-risk public health events should be removed from routine aggregated reporting to be reported only on an immediate basis.**

If another reporting channel already exists for a public health event which is intended to be reported through Argus, it is essential to integrate the data collection and reporting process to reduce the total workload at the healthcare facility level.

Once a final list of public health events to be routinely reported with Argus has been defined, the stakeholders group should reach an agreement on the information to be collected for each event. The number of variables will depend on the objective of public health surveillance. **For early detection of outbreaks via weekly aggregated reporting, it is recommended to keep the number of variables to a minimum, ideally reporting only number of cases and deaths, to avoid unnecessary burden on the healthcare facilities and maximize reporting efficiency.**

For each public health event to be routinely reported, the following parameters have to be defined:

- standard case definition of the public health event; and
- ± alert threshold to show an alert message if a variable has exceeded the threshold.

[1] European Centre for Disease Prevention and Control. (2015). Best practices in ranking communicable disease threats: a literature review, 13–15. https://doi.org/10.2900/653753

▶ 3.3 PARAMETERS FOR PUBLIC HEALTH SURVEILLANCE WITH ARGUS

Besides identifying priority public health events for public health surveillance, other parameters have to be defined prior to Argus implementation:

1. Number of levels of the public health surveillance system:
   - Data entry level (usually healthcare facilities at the peripheral level).
   - Level(s) responsible for validation, aggregation of data, and follow up of trends (usually intermediate and central levels).

2. Settings of the epidemiological week:
   - First day of the epidemiological week.
   - Day and hour for the peripheral level to send the weekly aggregated reports.
   - Day and hour for each level of the NPHSS to perform the validation process of the reports.

3. Contact people for alerts: supervisors to receive a copy of alerts sent by healthcare facilities on their personal mobile phone.
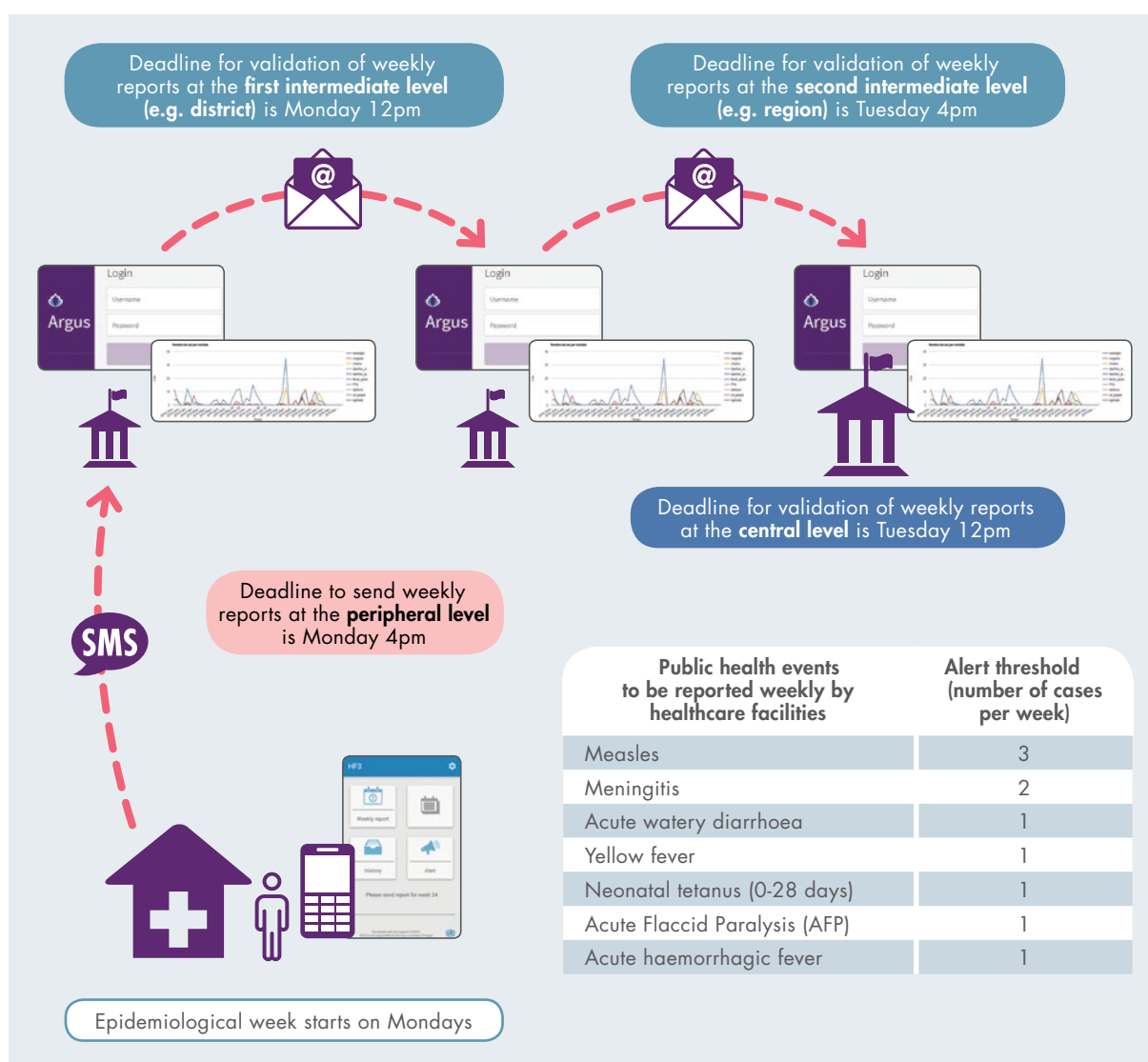

Public health events to be reported weekly by healthcare facilities	Alert threshold (number of cases per week)
Measles	3
Meningitis	2
Acute watery diarrhoea	1
Yellow fever	1
Neonatal tetanus (0-28 days)	1
Acute Flaccid Paralysis (AFP)	1
Acute haemorrhagic fever	1

Figure 6. **Example of Argus configuration**

4. ARGUS IMPLEMENTATION PLANNING

Several actions must be taken in advance for a successful Argus implementation, such as identifying specific staff for the project, defining where, when and how long the pilot phase will take place before potentially scaling-up to the national level, and securing funding to purchase the materials and services needed.

▶ 4.1 ARGUS STAFF

One of the first steps for Argus implementation is to identify the staff required for the project's success. At a minimum, the following staff should be designated for the project:

- A project officer in charge of:
  - monitoring the preparation and implementation of Argus and taking all requested actions for its success; and
  - ensuring timely provision of requested materials and services (including communication costs and internet access).
- An IT technician in charge of:
  - installing and maintaining Argus; and
  - providing support on the Argus Android application and Argus web platform to the users.
- An IT expert with strong knowledge and experience with the configuration of IT networks in charge of:
  - installing the IT solution; and
  - providing support for troubleshooting.

▶ 4.2 LOCATION AND DURATION OF THE PILOT PHASE

Before implementing Argus across the entire country, it is highly recommended to first **carry out a pilot phase to test Argus in a limited area** and evaluate its relevance and performance in the context of the country. The following criteria can be used to support the choice of districts/areas to be included in the pilot phase:

- low completeness and timeliness in previous reporting; and
- high number of cases of priority public health events in the previous years.

All healthcare facilities of the selected districts/areas have to be included in the pilot phase.

The pilot phase should last sufficiently long enough to obtain sound results for timeliness and completeness of reporting and to detect possible challenges to the project scale-up. Six months is considered an appropriate timeframe for running the pilot phase but each country can decide what is most suitable for the local context. Additional time for preparation (identify internet/telecom providers, purchase materials, install materials, train the users) and evaluation should be taken into account when planning for Argus implementation.

▶ 4.3 BUDGET

Implementation of Argus requires securing appropriate funding for different aspects such as procurement of hardware, printing user's documentation, training workshops, and internet and communication credit. The funding could come from the government budget and/or from external donors such as international organizations or bilateral cooperation.

The budget should be first planned for the duration of the pilot phase. If a scale-up is decided after the evaluation of the pilot phase, enough funding has to be provided to ensure continuity of the operation during the period between the pilot and the scale-up in the areas included in the pilot phase. Long-term resources to run Argus for public health surveillance should be secured before scaling-up Argus to the national level.

The equipment and services needed for Argus implementation are detailed in the **Annex**. It is necessary to ascertain their availability, cost and purchase modalities (including delays for delivery) to ensure all of these will be available in time to respect the planned timeline. To ensure the sustainability of the system, it is highly recommended to study the coverage of each mobile phone operator before Argus implementation and discuss the best modalities for reliable and affordable transmission of SMS between the healthcare facilities and the central server.

An example of a budget from an Argus pilot conducted in a West African country is presented in *Figure 7*.
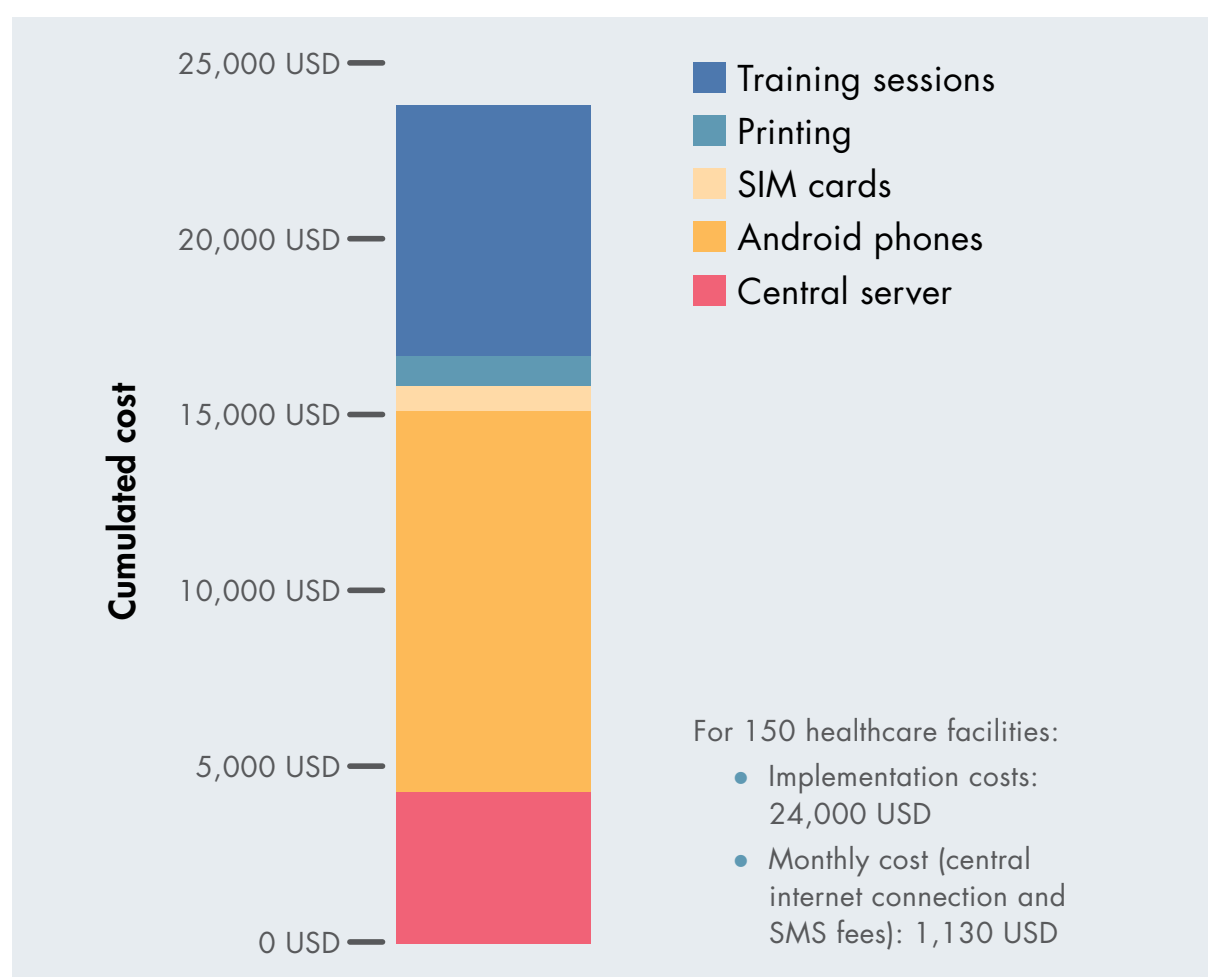

Legend:
- Training sessions
- Printing
- SIM cards
- Android phones
- Central server

Y-axis (Cumulated cost): 0 USD, 5,000 USD, 10,000 USD, 15,000 USD, 20,000 USD, 25,000 USD

For 150 healthcare facilities:
- Implementation costs: 24,000 USD
- Monthly cost (central internet connection and SMS fees): 1,130 USD

Figure 7. **Example of budget for Argus implementation**

5. ARGUS IMPLEMENTATION

▶ 5.1 MATERIALS, INSTALLATION AND MAINTENANCE

The server should be installed in a location with reliable 24/7 internet connection, ideally in the premises of an institution at the central level of the NPHSS.

One IT technician should be dedicated to the maintenance of the server and available to provide support on the Argus Android application and Argus web platform for users.

> An **installation kit** with documentation to install the server, the Argus web platform and the Argus Android application is available in the toolbox alongside this instruction manual.

▶ 5.2 USER TRAINING

Sound implementation of Argus depends heavily on appropriate user training. Training workshops should be delivered for users of the Argus Android application and users of the Argus web platform.

For each healthcare facility, there should be at least one person in charge of public health surveillance trained. At each level of the public health surveillance system (e.g. district, region, and central level), two people in charge of public health surveillance need to be trained (including the people in charge of the data validation). In addition, at the national level, the project officer and the IT staff must be trained.

Argus Android application users (staff in charge of reporting in each healthcare facility) should be trained on the following content:

- overview of public health surveillance and early warning and response concepts (1h);
- overview of Argus (30 min); and
- practical exercises for using the Argus Android application (45 min): each user to send a weekly aggregated report and an alert.

Argus web platform users (people in charge of public health surveillance at each level of the NPHSS) should be trained on the following content:

- overview of public health surveillance and early warning and response concepts (1h);
- overview of Argus (30 min);
- practical exercises for using Argus Android application (45 min): each user to send a weekly report and an alert; and
- practical exercises for using Argus web platform (1h): viewing reports, validating reports, analysing data, downloading the weekly epidemiological summary.

The first three parts of this workshop can be conducted simultaneously with the workshop for healthcare facilities' staff.

A sufficient number of Android phones/computers in order for all participants to do practical work must be provided during the training sessions. The number of participants in a single training session should be kept manageable.

If there are sufficient financial and human resources, a complementary on-the-job training can be considered. It allows users to obtain individual feedback in their working environment, answer specific needs or questions, and resolve issues related to hardware.

> A **training kit** with posters and leaflets for users is available in the toolbox alongside this Instruction manual.

▶ 5.3 ARGUS MONITORING

Argus' performance can be monitored weekly with the following indicators:

- **completeness of data reporting by healthcare facilities:** (number of reports sent / number of reports expected) x 100;
- **timeliness of data reporting by healthcare facilities:** (number of reports sent in time / number of reports expected) x 100;
- **completeness of the validation process at each level:** (number of reports reviewed / number of reports that had to be reviewed) x 100; and
- **timeliness of the validation process at each level:** (number of reports sent and reviewed in time / number of reports sent in time) x 100.

6. ARGUS EVALUATION AND SCALE-UP

▶ 6.1 EVALUATION METHOD

The main objective of the evaluation is to assess the usefulness of Argus during the pilot phase in the context of the country.

An **evaluation kit** with the protocol and tools for the evaluation is available in the toolbox alongside this Instruction manual.

The main results and lessons learned from the pilot phase should be communicated to all stakeholders in a timely, unbiased, and consistent fashion to decide on the scale-up of the project to the national level.

▶ 6.2 EVALUATION RESULTS ANALYSIS AND DECISION TO SCALE-UP

If the evaluation of the pilot phase shows successful results and it is decided to scale-up Argus across the entire country, the first step will be to identify sufficient and sustainable funding to finance its implementation in the remaining regions and ensure long-term operating costs.

A detailed plan must be developed to train the staff of the regions not included in the pilot phase; it should make best use of resources in terms of training venues, trainers, and equipment for hands-on training.

Before scaling-up to the national level, the stakeholders should review and validate the parameters defined for the pilot phase (based on the result of the pilot phase evaluation):

- list of public health events to be reported and variables to be collected;
- pre-defined thresholds for the different variables by sites and periods;
- first day of the epidemiological week;
- levels of validation process and aggregation of data (which levels must review the data, which analyses must be displayed at the different levels);
- deadlines to perform activities at the different levels (i.e. day and hour for the healthcare facilities to send their weekly aggregated reports, day and hour for each level of the NPHSS to perform the validation process of the reports);
- supervisors to whom a copy of alerts sent by healthcare facilities will be forwarded on their personal mobile phone.

ANNEX

▶ ## EQUIPMENT AND SERVICES REQUIRED FOR ARGUS IMPLEMENTATION

Equipment	Number
Central server = Computers or physical servers (one main and one backup) with: • Operating system Windows 7 or Windows 8.1, or Windows Server 2012 R2 • At least 16 Go RAM • Argus • High speed Internet connection with fixed IP address • Mouse, Keyboard, and Screen	2 central servers
A computer with • Available internet access	1 per unit in charge of the validation process and the analysis of the public health surveillance data
WiFi router (for the central server)	1
Premises adapted to receive the central server with: • reliable and continuous internet connection • reliable and continuous power supply • good coverage by the mobile phone operator(s) providing SMS communications	1
At central server level, Android phones to receive and send the SMS with: • Android operating system • Argus Gateway • SIM card	1 phone for 15 to 25 healthcare facilities sending reports
At healthcare facility level, phones with: • Android operating system (version higher than 2.11[2]) • Argus Android application • SIM card without Pin-Lock allowing the sending of SMS between healthcare facility phone and the central server of Argus • Application of parental control	1 phone per health facility sending public health surveillance data by SMS

[2] The minimum version of Android should be revised upward

Services	Coverage
Contract with mobile phone operator(s). Two modalities of contracts with the operators can be considered: • Subscription of a contract with one mobile phone operator for a "toll-free number" that will permit healthcare facilities to send free SMS to the central server. The payment would take place at the central level monthly based on the volume of SMS exchanged between the healthcare facilities and the central server. A constraint is that the "toll-free number" cannot be a short number and that the mobile phone operator should respect the SMPP protocol[3]. • Purchase of an amount of communication credit with one or several mobile phone operators. It has to be agreed with each mobile phone operator that each month they will receive a list of phone numbers with various amounts of credits to be put on each mobile phone. If communication credit is to be purchased and provided to the healthcare facilities, the credits should be distributed monthly and the amount to be distributed will vary accordingly with the number of SMS transmitted by each user.	For each phone used (central level and health facility level)
Internet connexion available for staff responsible for validating and analysing public health surveillance data	At district, regional and central level

[3] Short message peer to peer (SMPP)