1 DHIS2 Tracker improving surveillance of Visceral Leishmaniasis (VL) in Somalia - DRAFT
  1.1 Leishmaniasis – what is it?
  1.2 Who is affected by Visceral Leishmaniasis (VL)?
  1.3 Tackling VL in Somalia
  1.4 Ongoing WHO-supported training and surveillance programs
  1.5 Improving VL surveillance with DHIS2 Tracker and Event Capture
  1.6 Importing retrospective surveillance data into DHIS2 Event Capture
  1.7 Using DHIS2 for prospective data collection
  1.8 Several planned phases for gathering VL data
  1.9 An intermediary solution for now

2 DHIS2 in the Autonomous Region of Kurdistan, Iraq
  2.1
  2.2
  2.3 Key implementation challenges
  2.4 What’s ahead?
  2.5 In the news
  2.6 Handy resources
  2.7 Contact us!

3 West Africa Regional Systems and DHIS2
  3.1
  3.2
  3.3
  3.4
  3.5

4 Zambia Education Management System (EMIS)
  4.1
  4.2
  4.3
  4.4
  4.5
  4.6
  4.7
  4.8
  4.9

5 Rwanda HMIS powered by DHIS2
  5.1
  5.2
  5.3
  5.4
  5.5
  5.6
  5.7
  5.8
  5.9
  5.10

6 DHIS2 tracker e-Registry in Palestine
  6.1
  6.2
  6.3
  6.4
  6.5

7 Tanzania: Integrated Health Information Architecture
8 Tanzania: Integrated Health Information Architecture

8.1 About this use case
8.2 Tanzania country profile
8.3 Moving from multiple tools to a unified system
   8.3.1 Before DHIS2
   8.3.2 Introducing an integrated HIS in Tanzania
   8.3.3 A gradual, national HIS rollout
   8.3.4 Building a robust HIS
8.4 Challenges
   8.4.1 Unforeseen changes to the administrative structure
   8.4.2 Reducing standalone programs
   8.4.3 Lack of trained personnel and geographical coverage
8.5 The outcome
8.6 What are the lessons learned?
   8.6.1 Apply a gradual incremental process
   8.6.2 Develop and endorse a comprehensive national plan
   8.6.3 Establish a trustworthy relationship
   8.6.4 Build capacity at national, regional, and local levels
   8.6.5 Get other health programs involved
   8.6.6 Dedicate the right amount of time and resources to your program

9 DHIS2: a Management Information System at PSI

9.1 About PSI
9.2 Why did you choose DHIS2 at PSI?
9.3 How did you roll out DHIS2?
9.4
9.5
9.6 How many PSI countries are using DHIS2?
9.7 How are you implementing DHIS2?
   9.7.1
9.8
9.9 Do you provide DHIS2 training?
9.10 Which parts of DHIS2 are you using the most?
9.11 How do you help DHIS2 users?
9.12 Do you embed DHIS2 into other apps?
9.13 The Health Network Quality Improvement System (HNQIS) app
9.14 The Malaria Case Surveillance app

10 Zambia WASH: Mobile surveillance using DHIS2

10.1 Zambia in a few words
10.2 What is WASH?
   10.2.1 Tackling Open Defecation
10.3 What is Akros?
10.4 Before DHIS2
10.5 Utilizing DHIS2 for WASH
   10.5.1 Scaling up DHIS2-WASH from 2013 to 2016
   10.5.2 Working in a tribal context
   10.5.3 Maintaining an active interest
   10.5.4 Choice of phone technology
10.6 Rollout and Adaptation
   10.6.1 Clear, simple processes
   10.6.2 Defining Roles
   10.6.3 Promote a sense of responsibility
   10.6.4 Lessons learned
1.1 Leishmaniasis – what is it?

Leishmaniasis is a disease caused by what is known as “protozoan parasites”. Protozoa are microscopic, one-celled organisms that are able to multiply in humans, causing serious infections. Leishmansis is transmitted to humans by the bite of infected female sandflies.

The worst form of the disease is called Visceral Leishmaniasis (VL), and it is endemic in more than 80 countries. People usually suffer from irregular bouts of fever, weight loss, enlargement of the spleen and liver, and anaemia.

1.2 Who is affected by Visceral Leishmaniasis (VL)?

This disease affects some of the poorest people on earth. It is associated with malnutrition, population displacement, poor housing, a weak immune system and lack of financial resources. The most cases are found on the Indian subcontinent and in East Africa, where an estimated 200,000 – 400,000 new cases occur each year. Some 90% of all new cases are reported from Brazil, Ethiopia, India, Somalia, South Sudan and Sudan. Left untreated, VL will kill a person within two years of the onset of the disease in more than 95% of all cases. Source: Neglected tropical diseases, WHO, 2017 ©

1.3 Tackling VL in Somalia

Diagnosis and treatment of VL is not easy. In endemic countries, only few health facilities have well-trained health workers and the equipment to perform proper diagnosis and case
management. To be able to accurately map the distribution of VL cases and calculate incidence and population at risk, several factors come into play:

- Identifying health facilities where the resources will be targeted (training, equipment, drugs, diagnostic tests),

- Allocating cases to the probable place of infection (or at least place of residence), and not to the place where the person is being treated.

1.4 Ongoing WHO-supported training and surveillance programs

In view of the country’s difficult context, Somalia is doing very well in terms of VL surveillance. Since 2013, the Ministry of Health, with the support of the WHO and SOS Somalia, have trained health workers from three health facilities in VL diagnosis, case management, and data collection.

Individual data was collected for each VL case in an Excel spreadsheet and shared with the central level of the Ministry of Health. Basic descriptive analysis of the data was performed. However, the following limitations affected the quality of the data:

- No central database to store, clean and compile the data.

- No standardization of the locations where cases were detected.

- No skills at the Ministry of Health to map the cases at village level.

1.5 Improving VL surveillance with DHIS2 Tracker and Event Capture

In 2016, the WHO Global Leishmaniasis programme developed a generic “VL patient form” using DHIS2 Tracker, and a generic “VL patient register” using DHIS2 Event Capture. The objectives are to support the Somali MoH in using these generic modules to strengthen VL surveillance and control in Somalia.
1.6 Importing retrospective surveillance data into DHIS2 Event Capture

The WHO team developed an “Excel importer” app, based on an existing DHIS2 app from HISP Vietnam. VL event data from 2013 to 2015 was imported, and data was then available for analysis of Neglected Tropical Diseases (NTDs) surveillance and control.

A DHIS2 dashboard was implemented for Somalia, with main indicators, and a map representing VL cases from villages of residence as a proxy of the village of infection.

1.7 Using DHIS2 for prospective data collection

In February 2017, 24 health workers in Entebbe, Somalia received training on how to enter data in the WHO-VL modules. The training, performed by WHO and in collaboration with HISP Uganda, lasted for 5-days. Health workers learned about areas such as identifying the minimum data to be collected for each VL patient; DHIS2 tools and features for surveillance (individual and aggregated data entry, data validation, data analysis and working with dashboards); and practical sessions for data entry in Tracker Capture. At the end of the training, participants were expected to know how to:

- Connect to the platform,
- Enter individual and aggregated data,
- Validate their data using the data validation tools,
- Analyze the data through the interpretation of dashboards showing indicators required by the Leishmaniasis Programme.

1.8 Several planned phases for gathering VL data

Since this training, data entry is collected centrally in Mogadishu. This is a first phase, which aims at testing the usability of the Tracker “VL patient form”. The second phase is to invite the peripheral level to Mogadishu on a monthly basis to enter data in the “VL patient form”. The third phase is to test the possibility of entering data at the peripheral level.
1.9 An intermediary solution for now

Although initially three phases were planned for the VL control program in Somalia, due to logistic constraints, the peripheral level is continuing with the Excel solution, and the central level is tasked with uploading the data to DHIS2. The deployment of the “VL patient form” or the “VL register” is planned for a later stage, after further analysis of the technical requirements at the peripheral level.

This intermediary solution represents a substantive improvement for the Somali VL control programme. Indeed, it will enable better data quality, centralization of all the data in a single database, safeguarding of the data, easy sharing with main partners, improved data usage and improved feedback to the peripheral level.
2 DHIS2 in the Autonomous Region of Kurdistan, Iraq

For the citizens of war-torn Iraq, as well as for the hundreds of thousands of refugees stranded in camps and sheltered by the Autonomous Region of Kurdistan, getting access to regular health care is not a straightforward procedure.

2.1

In June 2015, a DHIS2 Health Information System was set up to assist the Kurdish health authorities in collecting population data and improving the access and quality of public health care.
A KRG-DHIS2 pilot project, funded by the Italian Ministry of Foreign Affairs and International Cooperation, led by the University of Rome Tor Vergata in cooperation with the Ministry of Health of the Kurdistan Regional Government, and realized by I-PRO and EuResist Network was deployed across a set of pilot health centers and hospitals in the Kurdish governorates of Duhok, Erbil and Slemani.

With 60 registered users spread across 30 health centers, 700 Kurdish medical professionals can now follow a staggering 180,000 health events! Indeed, just 18 months into the pilot project, there are now 7 primary/family health centers, 9 hospitals, and 14 general health centers. There are currently 10 health centers in rural areas such as small towns or villages, and there are 20 health centers in major towns.

Since January 2017, 110,000 cases have been imported via periodic uploads from existing and running databases, and 70,000 cases have been recorded by DHIS2 users. This great progress is enabling health professionals to gather statistics for disease diagnoses, hospital discharges, and registrations of births, deaths and immunizations.
The project is also using the WHO's International Classification of Diseases (WHO ICD-10), which is the standard diagnostic tool for epidemiology, health management and research purposes. This classification defines the universe of diseases, disorders, injuries and other related health conditions, listed in a comprehensive, hierarchical way. The data can be:

- Easily stored, retrieved and analysed for evidenced-based decision-making;
- Used for sharing and comparing health information between hospitals, regions, settings and countries;
- Making data comparisons in the same location across different time periods.

### 2.3 Key implementation challenges

With a small time frame to get a DHIS2 epidemiological surveillance pilot project implemented and deployed in the whole Kurdish region of Iraq, many challenges are ahead for the teams involved.

**Racing against the clock.** The first challenge lies in building a solution that works in a short time and satisfies the basic needs of the regional health system in collecting data. So far, a subset of the regional health centers, approximately 30 establishments, made up of rural and urban centers, family health centers, hospitals, hospital colleges, and general health centers have been involved in testing the system.

**Pulling in data from other systems.** Another challenge lies in making it possible to import existing data from hospitals into DHIS2 while also making it achievable to enter data from mobile devices. Additional challenges lie in preparing reports equal to those requested by the health authorities, and building a DHIS2 system for people who don't necessarily have a background in health.

**Testing using a small, live version of DHIS2.** The testing phase covered two areas: creating data sets with aggregate data entry and making programs with disaggregate event data capture. After analyzing the data reports produced by the tests, the project managers decided to use programs without registration using the Event Capture app.

**Capturing data with the Event Capture app.** In this region of Iraq, people do not have identification numbers. It’s therefore almost impossible to follow patients’ visits to different
health centers. Bearing this in mind, the team built a system to record basic health events such as births, deaths, immunizations, disease diagnoses and hospital discharges using the Event Capture app.

**Why the Event Capture app?** On the one hand, this app allows you to import existing data from hospital databases, while adhering to the same data structure. On the other hand, physicians or health technicians can enter data in real-time during a visit, without having to complete further data aggregation tasks. These two key areas combined were very helpful to our teams.

**Hosting.** Without the means to implement a dedicated server, we chose to use an outsourced hosting solution through a recommended company called **BAO Systems**. With this solution, it will be possible to scale up the DHIS2 instance in the future.

**Translating the UI into Kurdish-Sorani.** With the help of the DHIS2 community, DHIS2 developers and a translation team, the DHIS2 user interface is now available in Kurdish-Sorani, a language spoken by 6 million people in Iraq.

Some parts of the data model do not have translations. For example, the description of report dates were added in English, Arabic and Kurdish-Sorani consecutively: Date of birth / تاريخ الولادة / يفراري له دايلک بیوون / ISO 639-3 ckb, or the Kurdish-Sorani language, in the underlying Java library.

The screen captures here show the DHIS2-KRG Health Monitoring System user interface in both English and Kurdish-Sorani:

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2.4 What's ahead?

**Creating national health numbers for all citizens of the Autonomous Region of Iraqi Kurdistan.** The first focus for the upcoming years is to introduce a national health identity (HNID) for each citizen accessing health services provided by the hospitals and health centers monitored by and coordinated with the MOH of the KRG. Once this is in place, the HNID will be integrated into the Kurdish DHIS2 platform.
Expanding the system for a complete coverage of the Autonomous Region of Kurdistan. The second major goal set for 2021 is to involve at least 300 health centers in the KRG-DHIS2 platform, in order to reach a complete coverage of the territory.

Setting up a high-quality epidemiological health surveillance system in the Autonomous Region of Kurdistan. While achieving this goal, the teams hope to extend their DHIS2 expertise to other areas besides health, such as programs of demographic or environmental interest.

2.5 In the news

If you'd like to view a presentation of the DHIS2-KRG project to the Kurdish government and Italian Ministry of foreign Affairs, here's a recent video.

2.6 Handy resources

- Find out more about KRG-DHIS2 on the project web page.
- Read the KRG-DHIS2 HMS documentation:
  - How To documentation.
- KRG-DHIS2 playlist on YouTube

2.7 Contact us!

We’re very keen to give feedback about the progress we’re making with our KRG-DHIS2 project. If you’d like to ask us questions about our work, please reach out to us as follows:

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Opening a DHIS2 training center in KRG. © IPRO 2016.
3 West Africa Regional Systems and DHIS2

The West African Health Organization (WAHO) uses a regional data warehouse powered by DHIS2 to consolidate aggregate health data from the 15 ECOWAS (Economic Community of West African States) member states.

3.1

UIO and WAHO: An ongoing HIS-strengthening collaboration since 2011 UIO has assisted WAHO in building HIS capacity within the organization and in its member states. In 2013, an online regional data warehouse was set up using DHIS2.

At WAHO, the focus is on aligning data, disease and epidemiological surveillance technology, quality control and improved data standards.

3.2

Tackling how to better align our data. The disparity in the size of our member countries is a challenge. Take Nigeria and Gambia as examples of a huge country and a tiny country using DHIS2. Now imagine the challenge WAHO teams face when setting up a system to map data levels correctly between such hugely different structures, and consequently in the number and the size of the administrative levels.

3.3

Flexible Integrated Architecture. To address this situation, WAHO has developed a system called “Flexible Integrated Architecture” which groups data across three levels: one national level, and two sub-national administrative levels. The aim is to let each country decide which administrative levels in their country correspond to each of these levels in the regional data warehouse. This approach allows for comparison of data between countries of different size and with different organizational structures.

3.4

“What is WAHO looking to do with the data?” This is a question we’re often asked. For a start, we’re collecting data to provide countries with better visibility about outbreaks of epidemics. When you hear that there’s been an outbreak of say cholera in a country, you’ve no time to lose. With WAHO-DHIS2, we have a better chance of making decisions fast as we can read data, measure, and assess data, and act accordingly. When there’s an outbreak in a border area, there’s a high risk that infections will spread into the neighboring country. This is where the WAHO-DHIS2 technology can be used to share preventive information across several countries.
Quality missions to get reliable data. WAHO is actively working with countries to find the right indicators for their specific context. There are currently about 80 essential indicators in the regional data warehouse. They cover many areas such as demographics, disease burden, health service utilization, health financing, human resources and epidemic diseases. At the moment it is the epidemiological indicators that are being reported by countries, but the plan is to expand with the rest in 2016. There is indeed no one size to fit all and that is why WAHO is taking things on a case-by-case basis; working out which countries would benefit the most from certain sets of indicators more than other countries would. In the long run, if we can identify the right data measuring tools for each country, the data we will then collect will be of higher quality, which will drive better decision making.

The WAHO data warehouse is still in its early days. However, the organization is on the right track to building a solution that will, we all hope, bring unity and cohesion to how data is shared in the ECOWAS region.
Akros is an NGO that is experienced in the design and implementation of data-driven systems that improve the health and well-being of disadvantaged communities.

Following the highly successful Water, Sanitation, and Hygiene (WASH) program, which was rolled out across Zambia’s 172 districts, Akros is now using the same DHIS 2 visualization tool for chiefdoms to access education data. www.akros.com
Chief Cooma displays a visualization tool running on a tablet that gives him up-to-date reports on village-level sanitation data from his and other chiefdoms.

4.1

**Who is involved in this program?** This program is our latest project; it began in 2016. In partnership with the Ministry of General Education with support from UNICEF, Akros has developed and implemented an Education Management Information System (EMIS) in Namwala District, Zambia using DHIS2.

4.2

**What did the situation look like before this initiative?** Prior to this EMIS, the ministry depended on annual reports from schools that were put into a Microsoft Access database. The yearly reporting prevented data capture of critical education information like attendance or quarterly standardized exam scores. This placed significant limitation in terms of the data available to the ministry for decision and policy making at all levels.

4.3

**No reliable attendance data.** Prior to EMIS, yearly enrollment information was the only indicator available for the number of students going to school. As a result, the average daily attendance was often significantly different from enrollment figures.

4.4

**What type of data is being reported with DHIS2?** As mentioned, we’re capturing aggregate data on a monthly basis that shows us the enrollment and attendance figures of teachers and students. We also capture Water, Sanitation and Hygiene (WASH) information. We’re retrieving exam scores in literacy and numeracy, and lastly, we’re getting data on school feeding days and the commodities being consumed. For event capture, we’re gathering termly data about the drop-out rate of teachers and students and commodity requests for education materials, pens, textbooks, etc.

4.5

**An example of an EMIS indicator:** To work out the percentage of enrolled students attending classes, the indicator is calculated by adding all students attending class every day divided by the number of teaching days that month.

4.6

**How well is the EMIS system doing?** We’re making progress in areas such as helping teachers and chiefs to understanding the importance of data and accountability. Participants are becoming more aware of how standardized reporting generates consistent results. The decision-making data we’ve retrieved, in areas such as real-time attendance and learner outcome data, is more reliable than ever before. For example, the ministry can now see results as soon as exams are taken; interventions and teacher support can be immediately developed based on exam scores.

4.7

**And the challenges?** There was only yearly paper reporting prior to EMIS and so we’ve had a bit of a learning curve in terms of getting participants comfortable using a tablet to enter data with a matrix presentation. We’re striving to keep the data simple; we’ve moved from 27 pages of data down to 1 monthly report and one termly report. However, some paper trail still remains. Finally, we’re facing a challenge with the low capacity of data entry personnel available.
4.8

What's ahead? We're keen on setting up feedback loops that include teachers, Parent Teacher Associations (PTAs), chiefs, and district officers. We'd like to have standardized dashboards in place and data quality assessment tools that include validation rules and standard operating procedures. We're hoping to implement national level reports. Finally, we wish to scale to additional districts in Zambia. A lot to think about!

4.9

Photo by Alexis Barnes, Akros
5 Rwanda HMIS powered by DHIS2

Recognized as a trailblazer in its category, the web-based R-HMIS has been operational countrywide since February 2012 and collects data from over 700 public health facilities. With improved data reporting timeliness, completeness, and accuracy, R-HMIS has made sweeping changes to how health data is being collected and used in Rwanda today.

5.1

What did the situation look like before R-HMIS? With a system that was stretched to its limits, and lacking in capacity to gather data efficiently, it could at times take months to receive health reports from remote areas of the country. The data that eventually came through was likely to have passed through multiple sources and was usually not very reliable. The timing couldn't have been better for a completely new system.

5.2

A huge turnaround since February 2012. With the arrival of R-HMIS, web reports from every health facility in the country can be made available in a few clicks. Furthermore, data validation rules are keeping the data clean and of near to perfect quality.

5.3

A country rollout achieved in 4 years – absolute record time! After spending almost two years of thorough preparation, it took just two years for Rwanda's highly dedicated teams to roll out DHIS2 across Rwanda and make it the country's official web-based Health Information System.

5.4

Harmonizing an existing system. Resources such as people, registers, modems and computers were already available, so DHIS2 implementers took advantage of this infrastructure and focused on getting DHIS2 software up and running. Furthermore, in an effort to get everyone involved simultaneously, health personnel received intensive DHIS2 training at the same time as systems administrators working at the central level.

5.5

A concisely prepared rollout. “We harmonized all the reporting forms,” recalls Andrew Muhire, the head of Rwanda’s Health Management Information System at the Ministry of Health. “We ensured that we were only collecting highly relevant data or data that had direct links to our strategic plan. We selected program indicators that were linked to our targets: reducing the overall workload of our health personnel and improving the quality of data to drive decision making.”

5.6

A thoroughly revised system. The Rwandan DHIS2 experts went to great lengths to meet as many requirements as possible. For example, they revised data collection tools, including patient forms and registers, and health facility reporting tools. Standard operating procedures for data management at health centers and district hospital levels were introduced along with a routine data quality audit (DQA) system. Finally, referral hospitals, private dispensaries and clinics were integrated.

5.7

Getting teams up to speed with web-based technology was a priority. Intensive training took place very early on in the process. The aim was clear, the motivation was high: to empower local teams with the expertise necessary to control their country’s health data.
5.8

Data quality assessments showing excellent results. Data completeness is hovering at around 98% today. People at all levels within the health sector use the collected data; at district and at central level.

5.9

Migration of eIDSR, HIV and the TB system into DHIS2. We’re continually progressing with our HMIS; eIDSR - our disease surveillance system, HIV and TB systems are now migrated to DHIS2.

5.10

eIDSR in a few words: Using web technology or a mobile phone app, eIDSR enables users to collect and report real-time epidemic surveillance data from health facilities. Data is stored in a central database, where it can be instantly retrieved for analysis, dashboards and decision-making. Automated alerts and reporting reminders can also be triggered to keep health officers informed about potential outbreaks and reporting delays.
6 DHIS2 tracker e-Registry in Palestine

Developed from WHO's guidelines for Reproductive, Maternal, Newborn and Child Health (RMNCH), the DHIS2 Tracker e-Registry collects, analyzes and tracks case-based data for maternal and child health. The module is currently being rolled out in three of the 10 regions in the West Bank. The remaining regions will be covered over the upcoming months.

6.1 How did the Tracker come about? Primary health care is at a particularly low level for expectant women due to the volatile context within Palestine. The DHIS2 Tracker e-Registry was introduced in an attempt to improve the delivery of quality healthcare. The e-Registry captures essential health data through simple processes and a series of outcome indicators covering domains of quality of care. It also serves the dual purpose of patient management and public health monitoring. The project is being led by the Norwegian Institute of Public Health, with the involvement of the Palestinian National Institute of Public Health and the Ministry of Health in Palestine.

6.2 What was not in place before that is available now with Tracker? Tracker has provided national guidelines and support for clinicians when following individual cases. For example, if a clinician enters a lab result for a pregnant woman, let’s say the hemoglobin value, which indicates anemia, the clinician is alerted to the patient’s degree of anemia and will be prompted to take action accordingly. This information is powered by a powerful rule engine, and is based on WHO guidance about what actions to take in certain health situations.

6.3 What exactly is the DHIS2 Tracker e-Registry? The Tracker user interface is a checklist, which also provides decision support tools. The clinician goes through the dynamic data entry form while seeing the patient. Each section and question represents a point in the checklist that needs to be completed during the visit. The Tracker also focuses on task consistency and completeness. Furthermore, aggregate data is used for public health decision making at the national level.
6.4

**How successful has the program been?** We've a few hundred cases registered so far with Tracker in the West Bank roll out, so it's still in its early stages. However, we've identified a series of recommendations that may be useful for future DHIS2 Tracker implementations.

6.5

**What is the general feedback and what are the highlights of this program?** It's been positive on the whole so far. Using a rule-based workflow that is modifiable to match treatment guidelines helped no end. Also, achieving consensus on national standard treatment guidelines and developing proper governance are areas we recommend focusing on. We also believe that designing the system with the users and making the UI customizable are of great value. We recommend reviewing any existing systems and making efforts to integrate with and support them as this might bring long-term benefits.
Tanzania Mainland has come a long way in implementing and rolling out its HIS using DHIS2 technology. Over the lapse of five years, the country has succeeded in shifting from a system that had completely outgrown itself to a nationally supported system.

“How did you come so far, so rapidly?” is a question that the lead implementers, Wilfred Senyoni and Dr. Honest C. Kimaro, often find themselves answering. Building up local capacity is the first answer. Getting key partners and stakeholders involved very early on in the process is the second.

The combination of a highly committed team and an unrelenting attitude to getting the rollout done were contributors to this success story. Owing to a joint effort between the MoHSW, the University of Dar es Salaam and UiO, students and researchers have played an essential role in identifying and implementing open-source tools and technology; introducing that data collection standards; proactively engaging with communities for good usability input, and conducting “action-led research”.

Local capacity building helped shape the project. Tanzanian project managers were quick to gauge how vital the role of building up local teams with local expertise would be in establishing a strong backbone to their system. Instilling a sense of ownership, responsibility and accountability at all levels has made a huge difference in the quality and timeliness of reported data.

“We want to drive decision-making as much as possible using this powerful analytical to the full,” says Wilfred Senyoni. Indeed, the interoperability of DHIS2 with other systems is helping the MoHSW to gain visibility as to where and how to tackle the most pressing health issues within Tanzania. Good examples of this are the eIDSR tool that uses DHIS2 and USSD technology to detect and respond to infectious diseases, and eLMIS interoperability with DHIS2, which compares and triangulates the service delivery data with the logistics.

You can also read the longer version of this use case [here](#).
8 Tanzania: Integrated Health Information Architecture

8.1 About this use case

In this use case, we'll be looking at the different stages of how multiple teams collaborated with the University of Dar es Salaam (UDSM), the Ministry of Health and Social Welfare (MoHSW), and the University of Oslo (UiO) to implement Integrated Health Information Systems (HIS) in Tanzania Mainland. The key lessons learned were the importance of implementing a HIS gradually to provide a sustainable framework; streamlining resources and promoting collaboration; ensuring systems were flexible; promoting data ownership and data sharing; building capacity at all levels; involving major programs very early; and dedicating time and resources building up a community of stakeholders.

8.2 Tanzania country profile

The United Republic of Tanzania is the largest country in the East African region with a population of 45 million people. It's composed of two countries: the semi-autonomous island of Zanzibar and Tanganyika, or Tanzania Mainland. Tanzania Mainland is divided into 25 administrative regions that are subdivided into 167 district councils. Each district council is subdivided into divisions, wards, villages/streets. There's approximately one health facility per 8,000 people, according to SARA (2012).

Owing to a huge disparity between regions and districts in terms of geography, history, population, and infrastructure, some areas of Tanzania have no reliable roads, electricity, or access to the Internet.

8.3 Moving from multiple tools to a unified system

8.3.1 Before DHIS2

Tanzania Mainland's first HIS began in the 90s as a paper-based system used at health facilities and district offices. Information was collected and processed with a Microsoft Access database. Without the intervention of external consultants hired by funding agencies, there weren't any strategies to sustain the system with upgrades or refresher training.

With a surge in demand for a HIS, the MoHSW was being put under strain. Lack of coordination led to fragmented vertical projects running side by side. This caused an unsustainable situation in which efforts were being duplicated as results weren't being converged.

Around 2007, a plan called the Monitoring and Evaluation Strengthening Initiative was made by the MoSWH, UDSM, UiO and other partners. Its goal was to build a new, integrated HIS to provide reliable data for the ministry and other stakeholders. A new paper-based system combined with DHIS2 was introduced. [http://www.dhis2.org](http://www.dhis2.org)
8.3.2 Introducing an integrated HIS in Tanzania

In 2010, the adaptation and implementation of a totally revised HIS began. This process was enabled by a flexible, standard solution and participatory approaches operating across all levels of the national health system. It was important to find a solution that would meet the demands of health managers, implementers, designers and decision-makers.

8.3.3 A gradual, national HIS rollout

In 2011, the coastal region of Pwani was used as a testbed for paper-based data collection tools and DHIS2. Over the next two years, revised systems were rolled out to the remaining 24 regions and associated districts and health facilities of Tanzania Mainland. On completion of this rollout, efforts were directed towards the integration of all major vertical programs such as malaria, TB/leprosy, RCH, HIV/AIDS into DHIS2. Along with the implementation process, training programs were held for implementing partners, district and regional hospital staff, and the MoHSW staff.

8.3.4 Building a robust HIS

Here are some of the key areas we dedicated time and resources to:
8.3.4.1 Open-source philosophy

The choice to apply open-source tools rather than going through a closed, commercial product ensured that the software remained collaborative with a more diverse and flexible scope of design. Furthermore, the involvement of the many health sector stakeholders and an open source community of developers implied that the system would be geared towards long-term sustainability rather than a short-term lifecycle, dependent on a company's paid maintenance services.

8.3.4.2 Incremental, flexible, and scalable design

DHIS2 was implemented in an incremental way, rather than in one go. Like that, issues could be tackled directly during the rollout process, and implemented in direct response to user feedback. The most glaring flaws were thus easily spotted and a more stable and efficient system was built.

8.3.4.3 Standards for data collection

We used a set of common data collection standards that covered data collection, reporting, analysis, and quality procedures and tools. All informal tools were removed and the recording of duplicate entries of data declined.

8.3.4.4 Participatory design

A community of users such as managers from the HIS, supporting partners and implementers exchanged emails, spoke on forums, and at workshops about how to make the software more user-friendly. This helped implementers fine-tuned their programs and ensure that DHIS2 was being used optimally.

8.3.4.5 Action-led research

Students enrolled on PhD and MSc degree programs at UiO and UDSM conducted “action-led research” that enabled them to participate in the roll-out of DHIS2 while doing research. By doing so, they learned and documented best practices about system customization, user support, training, and data analysis.

8.3.4.6 Local capacity building

People learned to troubleshoot DHIS2 software, and users were encouraged to assist each other across many different organization levels and roles. By instilling a sense of ownership and self-sufficiency, the gap between implementers and users was thus reduced. Training focused on software usage, data analysis and basic and advanced features of DHIS2 for health and data managers.

8.3.4.7 Using information guidelines and standards

To drive decision-making and to reach national health goals, annual planned targets, and Millennium Development Goals (MDGs), teams created processes on how to generate and use data efficiently.

8.3.4.8 Interoperability of DHIS2 with other systems

Since 2014, DHIS2 has been integrated with other software systems, enabling health workers to cross-cut, analyze and share data across organizations. Here are some examples of systems integrated or made interoperable with DHIS2:
**8.3.4.8.1 eIDSR (electronic Integrated Disease Surveillance and Response)**

eIDSR was developed from scratch using USSD technology and linked with DHIS2 for the immediate reporting of data on infectious diseases. The tool is designed to improve detection and response time to diseases and is used within all health facilities in Tanzania.

**8.3.4.8.2 HRHIS (Human Resources for Health Information Systems)**

HRHIS was developed to report health data information from within all Tanzanian health facilities. It has helped to assess HR problems, manage the distribution of HR, and plan and evaluate HR interventions.

**8.3.4.8.3 MFL (Master Facility List)**

MFL is a health facility register to keep records about health facility profiles.

**8.3.4.8.4 eLMIS (Logistics Management Information Systems)**

eLMIS is a supply chain system for distributing and stocking of drugs and other commodities.

**8.3.4.9 Data use and awareness solutions**

Solutions to raise awareness about best practices for data use, data analysis and data dissemination have been embedded within DHIS2. These solutions are:

**8.3.4.9.1 Scorecards**

Scorecards are used to communicate the status of progress toward key global, regional and national commitments for specific indicators. The representation of visual indicators has the role of stimulating actors to respond to situations rapidly through effective policies and investments.
8.3.4.9.2 HMIS web portal

The HMIS web portal is hosted by the MoHSW and used by health stakeholders. It's also accessible to the general public. [https://hmisportal.moh.go.tz/](https://hmisportal.moh.go.tz/)

8.3.4.9.3 P4P (Pay for Performance)/ RBF (Result Based Finance)

Rewards the delivery of one or more outputs or outcomes by one or more incentives that can be financial or otherwise. The P4P/RBF program is integrated within DHIS 2 to enable health service providers to monitor their performance and payments.
8.3.4.9.4 DHP/RHP (District and Region Health Profile)

Provides planning and progress guidance to the district health management team. For example, it offers a summary of district health conditions through priority health indicators that reflect the district health status of the population, status of the health systems and the status of the health services delivery.

8.4 Challenges

As with any big project being implemented on such large scale and with a complex health care setting, a number of challenges arose.

8.4.1 Unforeseen changes to the administrative structure

District and regional administrative boundaries are frequently updated. The foundation of a new region generates a new representation of local population data. This disruption has an impact on the comparative analysis of HIS data such as the performance of health indicators.

8.4.2 Reducing standalone programs

Reducing the amount of existing standalone programs was often achieved through demonstrating the limitations of individual programs, and highlighting the potential of DHIS2. Due to some reservations however, some vertical programs are still running in parallel with DHIS2.

8.4.3 Lack of trained personnel and geographical coverage

The lack of people with adequate HIS skills has at times weighed heavily on implementing and scaling up DHIS2 from a pilot region to the entire country. Tanzania has over 7000 health facilities across 168 district councils.

8.5 The outcome

Now an endorsed and standard system of choice throughout Tanzania, DHIS2 is recognized as follows:

- An integrated e-health architecture that has strengthened health data collection, improved the analysis, use and harmonization of data and stakeholders.

- Over 1.5 million data entries are being collected and added to the national data warehouse on a monthly basis, using modems, broadband LAN and VSAT.

- Multiple, reliable, integrated tools to assist in improved evidence-based decision making (such as scorecards, dashboards, P4P).

- Open access initiative (HMIS web portal) initiated by the community of stakeholders.

- Improved data validation and quality checks for better monitoring and evaluation of health programs.

8.6 What are the lessons learned?

Here are some key lessons to take away from the experience of rolling out DHIS2 in a sustainable way.

8.6.1 Apply a gradual incremental process

The systems must be flexible and adaptable to meet emerging needs. By learning from previous iterations it has been possible to extend the system to other regions.
8.6.2 Develop and endorse a comprehensive national plan

To save on resources and prevent running the risk of duplicating efforts, before deploying DHIS2, streamline all resources and HIS activities of all stakeholders and use the MoHSW as a lead organization.

8.6.3 Establish a trustworthy relationship

Promote system and data ownership within the MoHSW. Encourage data sharing amongst the health programs and stakeholders to help develop a sense of trust in the routine HIS and the resources and capacity that can support it.

8.6.4 Build capacity at national, regional, and local levels

A reliable system is maintained by well trained and knowledgeable people. Capacity building needs to be a continuous strategy. Capacity is needed for system development, maintenance, and information use to make sure the system is up and running every day, and information generated is used for health management, planning and decision making.

8.6.5 Get other health programs involved

The major health programs are HIV/AIDS, Maternal Child Health (MCH), malaria and TB. Getting such big programs as these involved in a HMIS at an early stage is a means to spark the interest of other programs and associated stakeholders.

8.6.6 Dedicate the right amount of time and resources to your program

Lots of time and effort was spent integrating the vertical programs into the HIS/DHIS2 platform and gradually rolling out the HIS. Today we’ve established a large community of stakeholders who share a common interest in building a sustainable HIS/DHIS2 platform for future generations to use and build upon.
9 DHIS2: a Management Information System at PSI

This interview was conducted in May 2016, with Sarah Romorini, senior program manager at PSI. The aim was to learn how DHIS2 was rolled out and how it's being used by PSI today. Sarah Romorini has worked with PSI for the past ten years, most recently with the implementation of DHIS2.

9.1 About PSI

Founded in 1970, PSI provides lifesaving products, clinical services and behavior change communication that empower the world's most vulnerable people to lead healthier lives. PSI works in partnership with local governments, ministries of health and local organizations to create health solutions that are built to last.

PSI has over 8,900 staff working on-site and with its affiliates in more than 60 countries. In 2014, PSI's revenue was calculated at $631,229,922 USD.

9.2 Why did you choose DHIS2 at PSI?

In 2011, PSI began its search for a better Management Information System (MIS). Until then, we'd been using a different MIS in every country. Even within countries we'd have different systems for different projects. We were stuck with highly customized systems for every project; a mix of a Microsoft Excel, Access, and other tools. Programs were cobbling together pieces of information to see trends and analyze their programs. Accessing data like this wasn't very efficient.

All of these unique, siloed systems led PSI to reflect upon two larger questions: how does PSI want to engage with its information, both locally and globally? And how do we want data to influence both the strategic and everyday program questions that PSI tackles?

We chose DHIS2 for its ability to collect, manage, and visualize information. This system makes it easier for our programs to collect information and make data-driven decisions. It's an incredibly powerful and flexible resource!

For example, users can set up their own entry forms, indicators and reports. DHIS2 is easily integrated with other interfaces. We especially liked that data collection and monitoring can be adapted for all program areas, including referrals, health services, sales and distribution.
9.3 How did you roll out DHIS2?

We did it in true PSI fashion; we dived right in! We started with pilot projects that were rolled out nationwide in Kenya, El Salvador, Uganda and Senegal. It was a huge benefit to have a low-complexity country like El Salvador and a high-complexity country like Kenya and Uganda using DHIS2.

9.4

Kenya was PSI's largest pilot project for DHIS2. In Kenya, there's a wide range of programs on DHIS2, including malaria, HIV, family planning, social franchising, hypertension, sales, cervical cancer, and others.

9.5

In El Salvador, PSI's reproductive health program was the first to join DHIS2. This helped monitor the effectiveness of interpersonal communication, quality assurance visits, and provider performances.
9.6 How many PSI countries are using DHIS2?

After setting up our two pilot projects, DHIS2 grew very quickly. PSI has over 20 countries reporting their data using DHIS2 on the production server and several more are in development. Over 60 PSI countries use DHIS2 to report their monthly aggregated health services data.

9.7 How are you implementing DHIS2?

We work closely with PSI’s country teams so they feel empowered to use, manage, and analyze their data using DHIS2. During our implementations, in-country DHIS2 stars are identified and PSI provides coaching and assistance to empower them to integrate data for decision making into their every day program management.

9.7.1

We also identify local technical leads who can support DHIS2 maintenance and adapt the system to meet their teams’ needs. For example, we’re implementing DHIS2 in Zimbabwe. Our team is working closely with our “local star” there, and he’s learning how to build and do the configuration himself. It’s exciting to see how DHIS2 is really owned by PSI Zimbabwe—the data in DHIS2 is theirs and they’re using it. This is the kind of goal we aspire to.

9.8

PSI collaborates with DHIS2 builders, who do the technical configuration work, that is, building the DHIS2 system to match the DHIS2 blueprint, which is based on the PSI country team’s data use needs.

We collaborate with HISP agencies in India, Vietnam, Uganda, West Africa, and Colombia. We also work with BAO Systems, the largest US-based DHIS2 consulting and hosting firm in North America, for configuration support. [https://baosystems.com/](https://baosystems.com/).

DHIS2 builders are supervised by PSI’s DHIS2 architects. They ensure our configurations are of high quality, and they train local technical leads and help DHIS2 builders to learn our standards.
9.9 Do you provide DHIS2 training?

As part of our long-term sustainability goals, we’re offering more training opportunities for local PSI staff on DHIS2 administration and data usage. Before, we would create these trainings a little on-the-fly because there were fewer countries, but now we’re starting to create more standard, ready-to-go training resources.

9.10 Which parts of DHIS2 are you using the most?

We’re using the aggregate data forms most. PSI is looking into using Tracker to look at individual data, register individual cases, track individual cases and then conduct surveys.

9.11 How do you help DHIS2 users?

We’ve recently transitioned to BAO Systems to help PSI to field its help desk tickets. We try to have a local DHIS2 administrator in each PSI country we work in. This person can usually field basic questions, like how to reset a password, or intermediate ones, like how to create a new form.

9.12 Do you embed DHIS2 into other apps?

PSI develops custom reports and apps to make real time data collection and analysis even easier. Our apps address key strategic and technical areas, including franchise management and provider performance, improving network quality, and case surveillance (such as malaria).

9.13 The Health Network Quality Improvement System (HNQIS) app

We developed the HNQIS app to improve network quality and provider performance. It helps Quality Assurance (QA) officers plan their supervision routes and target low-performing providers with high client volume.

Image: HNQIS app being used in Glory Clinic in Nairobi, Kenya.© PSI

9.14 The Malaria Case Surveillance app

PSI uses this mobile app in Cambodia to report positive malaria cases in almost real-time. Pharmacists collect basic data points such as geographic location, type of malaria detected and
age and gender of the client. It helps us to identify outbreaks and re-direct resources to where they are the most needed. You can check out the app here: [Google Play](https://play.google.com).

*Image: A pharmacist in Cambodia uses the Malaria Case Surveillance app. © PSI*
10 Zambia WASH: Mobile surveillance using DHIS2

The government of Zambia is actively working towards an end to open defecation—a huge challenge for many governments. Akros is supporting the government in this goal through water, sanitation, and hygiene programs that use mobile surveillance technology at the community level. The community level data collection and feedback system, which relies on DHIS2, has demonstrated that over 2.5 million Zambians have gained access to adequate latrines in rural areas since 2014.

10.1 Zambia in a few words

Zambia is a landlocked, primarily-rural country in sub-Saharan Africa. Of its ten provinces, eight are rural. The population relies on a mixture of construction, agriculture, manufacturing, mining, and other sectors for economic prosperity. However, in spite of recent economic growth, as of the 2013-2014 Demographic Health Survey more than half of the population did not have access to improved sanitation facilities.

10.2 What is WASH?

Water, Sanitation and Hygiene, also called WASH, comprises several interrelated public health concerns such as access to safe water, adequate sanitation, and proper hygiene education. Carefully structured WASH programs can help increase life-expectancy and economic productivity.

10.2.1 Tackling Open Defecation

Open defecation is a huge environmental health issue in developing countries such as Zambia. Defecating in the open, where flies can fly freely between food and feces, increases the risk of diarrhoeal diseases.

In an effort to eliminate open defecation, Akros has supported the Government of Zambia, UNICEF and other development partners to extend a DHIS2-based WASH data collection platform to more than 20,000 villages. This system enables government officials and local chiefs to monitor progress towards the elimination of open defecation in their wards and chiefdoms in real-time. Village-level WASH data has given local chiefs and government officials the ability to follow-up with specific villages that lag behind in the uptake of latrine construction and use—which, for the first time, has led to multiple open defecation free (ODF) districts in Zambia.

10.3 What is Akros?

Akros is an NGO that is experienced in the design and implementation of surveillance systems. Akros supports the implementation of WASH programs in Zambia through low-cost feature phones and innovative feedback mechanisms. Akros supports community-level tracking of latrine construction and uptake across nine of Zambia’s 10 districts. www.akros.com.

10.4 Before DHIS2

In 2012 UNICEF began making massive investments in Zambia with its Community-led Total Sanitation (CLTS) program, a methodology for mobilizing communities to completely eliminate open defecation (OD). This program, however, depended on paper records to be collected and physically delivered to the district level from the villages. This process could take 6 months or longer and left UNICEF, partners, and the Ministry of Local Government and Housing with stale and unusable data.
10.5 Utilizing DHIS2 for WASH

When a Zambian-based consultant introduced the Akros country director to DHIS2, things took a swing in a different direction. DHIS2, or “District Health Information Software”, is a flexible, open source software platform used in more than 40 countries. With the help of dashboards, charts, pivot tables and maps, DHIS2 makes data aggregation and data visualization very easy to create, understand and share. [http://www.dhis2.org/](http://www.dhis2.org/)

10.5.1 Scaling up DHIS2-WASH from 2013 to 2016

In 2013, Akros implemented its first DHIS2 pilot for the WASH project. Thereafter, the electronic WASH surveillance system was scaled to additional districts with a vision of eliminating OD countrywide. Currently the CLTS project has been implemented in 70 districts using the DHIS2 platform.

10.5.1.1 Stage 1: Champions at the grass roots level

Local stakeholders have played a key role in community level sensitization campaigns that highlight the dangers of OD. With guidance from the Government of Zambia and other partners supporting CLTS, at the village level, volunteers form Sanitation Action Groups (SAGs). These volunteers are equipped with CLTS data collection sheets and collect data on household sanitation, trachoma monitoring, and available access to clean water. Typical survey questions cover areas such as the existence of a latrine in a household and if that latrine is equipped with a lid; access to hand washing and water, soap, or ash; access to bathing shelters; the availability and cleanliness of drinking water, and so forth. SAGs work closely with selected individuals called Community Champions (CCs), who collect data from the SAGs and aggregate and submit the data through their mobile phones to DHIS2.

10.5.1.2 Stage 2: Reporting

The collected paper-based data is checked by the Community Champions. The data is then submitted via a hand-held device, usually a low-end feature phone that runs a DHIS-J2ME platform, to the next level in the process; the Environmental Health Technicians (EHTs). Thanks to Java technology, the cost of sending data via the DHIS-J2ME platform works out to be ten times cheaper than using standard text messages.

10.5.1.3 Stage 3: Troubleshooting and verifying data

Once a Community Champion submits aggregated data through their mobile phones, this data is made available to all key stakeholders who receive automated HTML performance reports on a given village. The data is then reported to the next level, the village chief, via an Android DHIS2 app.
10.5.1.4 Stage 4: Data through the Chief’s eyes

With the help of a Data Viewing Widget on a tablet, referred to as the “Chief App”, the village chief is able to look at the data that his advisors have gathered and make decisions based on what he sees. The chief holds his headmen accountable for any irregularities that could reduce his influence or impinge his reputation. The chief may at times carry out sanctions against underperforming headsmen, or on the contrary, give incentives, typically in the form of mobile phone credit, to high performers.
10.5.1.5 Stage 5: District monitoring

At the district-level the CLTS Focal Point Person (FPP), logs on to DHIS2 on a monthly basis to monitor ward and village propagation of improved latrines and progression towards ODF status. This person also shares relevant information with the District Commissioner and Town Planner.

10.5.1.6 Stage 6: Quarterly ward meetings and ODF status

Each ward has a quarterly CLTS meeting to allow representatives from all the villages in the ward to discuss challenges and share successes towards latrine propagation and progress towards achieving ODF status. The event serves to engage the SAGs to continue community sensitization towards achieving ODF status.

On a monthly basis, CCs and EHTs track ODF status of villages in their wards through their mobile phones, and district officials track ODF status of villages through their DHIS2 dashboard. The CC, EHT or district official can select a particular village from a drop-down list, and can see a bar from 0% to 100% indicating the status of that village in working towards 100% ODF.

Once a village achieves ODF and is verified, the District CLTS FPP logs on to DHIS2 and selects “ODF Verified” next to the village's name, which changes the color of the village name to green.

10.5.2 Working in a tribal context

Zambia is a hierarchical society with strict codes about status. There are roughly 150 chiefdoms. The traditional village chiefs are in charge of all the decisions in the village and very little can be achieved without their approval. They are the custodians of the villagers; ensuring their health and social-economic well-being. Communicating about DHIS2 and obtaining meaningful results required bringing onboard the chiefs within each village. Introducing technology through the means of a tablet was, in some cases, a huge yet surmountable change for certain chiefs.

10.5.3 Maintaining an active interest

As the WASH project got underway, a spirit of competition started to emerge amongst village chiefs. Vying for the best results, the chiefs soon became actively involved in overseeing the implementation and follow up of WASH-related activities within their communities. Thanks to automated DHIS2 data feedback loops such as SMS messages, customized dashboards, PDF reports and the Chief's data visualization widget that could be interpreted extremely easily, even illiterate participants could access the trends and progress of their community’s efforts.

10.5.4 Choice of phone technology

One of the first challenges that came up was to get participants up to speed using mobile phone technology. Initially, participants were given Galaxy smartphones to work with, but this soon proved to be a bad choice. The design of the menus and complexity of certain applications was completely baffling to some. Even typing with a touchscreen was challenging for certain participants, who had never used a touchscreen phone. Also, due to the sensitivity of the touchscreens, participants would inadvertently change the phone settings, such as the keyboard layout to a different language, and not know how to revert the situation. Applications running in the background would also consume too much of the phone's resources. In sum, due to their limited battery-life, fragile screens, interface complexity and highly coveted appearance, smartphones had to be replaced. Low-tech yet robust feature phones that could run DHIS2 Java-based applications were introduced. Reporting soon rocketed as a result of this turnaround and the progress of the WASH program instantly improved.
10.6 Rollout and Adaptation

10.6.1 Clear, simple processes

Keeping the DHIS2-WASH system simple to use and clear to understand at all levels was the key to its successful implementation. Data collection forms, such as the one in the example below, can be completed very easily by community volunteers who retrieve information in each village.

**WASH F&E SAG Data Collection Form**

SAG data collection form with WASH and F&E data elements

| Organization unit identifier | January 2015 |

<table>
<thead>
<tr>
<th>Number of Households</th>
<th>Village Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>F&amp;E: Households clean &amp; free of human feaces</td>
<td></td>
</tr>
<tr>
<td>F&amp;E: Number of children present under 9 years old</td>
<td></td>
</tr>
<tr>
<td>F&amp;E: Number of children present with clean faces</td>
<td></td>
</tr>
<tr>
<td>Latrines (pit with platform) in Use</td>
<td></td>
</tr>
<tr>
<td>Latrines: Built after CLTS Triggering</td>
<td></td>
</tr>
<tr>
<td>Latrines: Smooth Cleanable Floor</td>
<td></td>
</tr>
<tr>
<td>Latrines: Lids on top of the hole</td>
<td></td>
</tr>
<tr>
<td>Latrines: Superstructure Providing Privacy</td>
<td></td>
</tr>
<tr>
<td>Latrines: with Hand Washers with Soap or Ash</td>
<td></td>
</tr>
<tr>
<td>Latrines: Adequate</td>
<td></td>
</tr>
<tr>
<td>Water: Number of Protected Water Points</td>
<td></td>
</tr>
<tr>
<td>Water: Number of Boreholes giving clear good tasting water</td>
<td></td>
</tr>
<tr>
<td>Water: Number of Hand Dug Wells giving clear good tasting water</td>
<td></td>
</tr>
<tr>
<td>Water: Number of Tap Stands giving clear good tasting water</td>
<td></td>
</tr>
<tr>
<td>Water: Community has funds to fix water points</td>
<td>[No Value]</td>
</tr>
</tbody>
</table>

By keeping data collection sheets simple, by using clear data indicators, this meant that the data entered into the system was also clear and only critical information was retained. As a result, analyzing and interpreting the data was much more straightforward. Another benefit of using very basic indicators was that any errors that slipped into the data could be spotted and rectified fairly simply.

10.6.2 Defining Roles

Akros has created three detailed end-user capacity assessments: the Stakeholder Role Rubric, the CLTS Surveillance Protocol and the CLTS Events Protocol. These documents serve the purpose of defining what each person does within a program so as to avoid ambiguity about responsibilities. Furthermore, the documents help to improve, monitor and assess the implementation of CLTS programs at the different roll out stages.
10.6.2.1 Stakeholder Role Rubric

This document can enable a Community Health Worker to understand the full scope of his or her role. For example, they would know that they would be in charge of decision making in areas covering disease diagnosis, treatment administration, patient referrals, and commodity resupply checks. They would also know about the reporting requirements to follow such as the frequency and method to use.

10.6.2.2 CLTS Surveillance Protocol

The Surveillance Protocol is a document that is used to assign monitoring methodologies for each event. It is a detailed analysis of surveillance techniques against each critical event in CLTS deployment. Responsible parties, periodicity, the role of automated functions and manual (surveillance officer) functions are all identified.

10.6.2.3 CLTS Events Protocol

The CLTS Events Protocol is a document with a more detailed description of the critical events to be monitored. Responsible parties, periodicity, purpose and expected outcomes are identified, along with a brief narrative for context.

10.6.3 Promote a sense of responsibility

Promoting a sense of data ownership amongst participants has a great influence in helping to build up sustainable programs. It is therefore important to develop standard operating roles, by outlining the tasks and duties of every person interacting with the system.

Thus by making participants feel responsible for the data they're in charge of and by promoting how their role is connected to the successful outcome of a CLTS project, this helps to maintain the flow of communication between all of the levels involved, whether it be at village, ward, constituency, district, province, national or organizational level.

10.6.4 Lessons learned

10.6.4.1 Backwards compatibility

Everything has to be backwards compatible to make upgrades into a smoother process. For example, in 2013, DHIS2 version 2.1.4 was unable to handle the growing volume of users as more and more districts started to use WASH. The system had to be upgraded, due to the number of legacy issues and bugs that were encountered. However, this was not a straightforward task and meant re-installing applications on all devices.

10.6.4.2 Using clones of tried and tested WASH programs

Akros learned that it was beneficial to use clones of production instances as a means to ensure stable implementations of WASH. Upgrades were performed on the cloned instances and then upgrades were applied to the production instances. By proceeding in this anticipatory manner, costs were kept down and troubleshooting was reduced.

10.6.4.3 Use data to drive decision making

Using DHIS2-WASH is one thing; in fact it's the easiest part. Getting people to use the data in order to drive decision making is the real challenge. To achieve this, Akros made it clear that all participants in a program should understand their role, responsibility and their intrinsic value within the program. Creating a sense of data ownership and a sense of accountability was therefore crucial. For example, by generating DHIS2 reports, district officers had the possibility to
make comments about areas of improvement within their district. This information was then forwarded to a provincial coordinator who took action at his or her level.

Lastly, by ensuring that communication channels remained active and were maintained, Akros was able to see how their CLTS program took on more importance and credibility, which in turn generated positive results and recognition in many areas.