



Regional Action Through Data

Digital Health Landscape Analysis

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Empowering Action.
Changing Lives.

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Acronyms and Abbreviations

AFRO	African Region
ALCO	Abidjan-Lagos Corridor Organization
ASN	Advance Ship Notice
AU	Africa Union
CARMMA	Campaign on Accelerated Reduction of Maternal Mortality in Africa
CDA	Clinical Document Architecture
CDC	Centres for Disease Control
CFR	Case Fatality Rate
CR	Client Registry
CSD	Compact Shared Document
DHIS	District Health Information System
DHS	Demographic and Health Survey
EAC	East Africa Community
eDVDMT	Electronic District Vaccine Data Management Tools
ECOWAS	Economic Community of West African States
EEOC	Ebola Emergency Operations Centres
EMR	Electronic Medical Record
Epi-Info	A suite of tools for statistical analysis within the public health context.
FP	Family Planning
FR	Facility Registry
GBD	Global Burden of Disease
GHO	Global Health Observatory
GHSA	Global Health Security Agenda
HCW	Health Community Worker
HIV	Human Immunodeficiency Virus
HIS	Health Information System
HMIS	Health Management Information System
HL7	Health Level 7
HWR	Health Worker Registry
IDSR	Integrated Disease Surveillance and Response
IGAD	Intergovernmental Authority on Development
IHE	Integrating the Healthcare Enterprise
IMS	Immunization Management System
MARA	Mapping Malaria Risk in Africa
MAGPI	A cloud-based tool for mobile data collection and data visualisation.
MDG	Millennium Development Goals
MDSR	Maternal Death Surveillance and Response
MIC	Malaria Indicator Survey
MICS	Multiple Indicator Cluster Surveys
MCH	Maternal and Child Health
MNCH	Maternal, New-born and Child Health
NCD	Non-Communicable Disease
NGO	Non-Governmental Organization
NTD	Neglected Tropical Disease
OIE	World Animal Health Organization
PIX	Patient Identifier Cross Referencing
RAD	Regional Action Through Data
Rapid-Pro	A visual tool for creating automated SMS workflows
REC	Regional Economic Community
REDISSE	Regional Disease Surveillance Systems Enhancement
RIGO	Regional Intergovernmental Organization
RMNCH	Reproductive, Maternal, New-born and Child Health
SARA	Service Availability and Readiness Assessment Survey
SDGs	Sustainable Development Goals
SDI	Socio Demographic Index
SHR	Shared Health Records
SWEDD	SAHEL Women's Empowerment and Demographic Dividend
SRH	Sexual and Reproductive Health
TB	Tuberculosis
UNHCR	United Nations High Commission for Refugees
USAID	United States Agency for International Development
WARDS	West African Regional Disease Surveillance
WAHIT	West Africa Health Informatics Team
WAHO	West African Health Organization
WHO	World Health Organization
XDS	Cross-Enterprise Document Sharing
XML	Extensible Mark-up Language

1. Executive Summary

The goal of the Regional Action Through Data (RAD) project is to support regional intergovernmental organizations (RIGOs), as well as member states, in their efforts to use data and analytics to inform actions that contribute to improved health and development outcomes in Sub-Saharan Africa. To achieve such a goal, the RAD project is focused on the regional level (sub-purpose one), as well as the client-provider level (sub-purpose two).

Year one of the RAD project was dedicated to conducting a landscape analysis, with the goal of producing a body of evidence that informs the future implementation of the project. The geographic scope of the landscape analysis was Sub-Saharan Africa, with a focus on East and West Africa, since the RAD project is working initially with the Intergovernmental Authority on Development (IGAD), as well as the West African Health Organization (WAHO). The methodology of the landscape analysis was comprised of several activities, which included stakeholder engagements, desk reviews, key informant interviews, as well as site assessments.

Through the landscape analysis, the RAD project defined the needs related to sub-purpose one, which included support for developing the capacity required to aggregate data from disparate sources at the regional level, as well as support for improving the development, dissemination, and utilization of health information. Through the various landscape analysis activities, the RAD project uncovered several existing information products (13), relevant projects and initiatives (28), data sources (23) and regional policy implications in East and West Africa that were of significance to sub-purpose one. An analysis of the above-mentioned findings, and the information therefrom, was used to inform the proposed regional solutions to be developed by the RAD project under sub-purpose one.

The RAD project also defined the needs for sub-purpose two, which included the development of a digital solution to improve continuity of care across international borders for cross-border mobile populations, including pastoralists, with an initial focus on immunization and MNCH. Through the various landscape analysis activities, the RAD project investigated the cross-border context, in terms of patient identification and available technologies, as well as MNCH application solutions. In addition, the RAD project looked at several country eHealth profiles, and assessed the reality on the ground in terms of site assessment findings, such as facility infrastructure, border crossings, patient identification, immunisation records, supply chain management, health workforce, data use and gender.

The findings from these activities were considered to inform the proposed technical architectural approach, as well as the actual technical architecture. Policies of relevance to sub-purpose two were also analysed by the RAD project to ensure that the proposed approaches and architectures were viable.

The key emerging themes from the stakeholder interviews on data issues during the landscape analysis are:

- National data is typically fragmented, incomplete, received late and irregular. There is need to harmonize reporting requirements and enhance data quality to ensure high-quality and timely data.
- Absence of formal policy with regards to cross-border health data sharing and need to have a unified directive related to data sharing, as well as a shared data platform to support information sharing across borders;
- Weakened disease surveillance reporting systems (irregular, inaccurate, low number of sentinel sites and low coverage) and need to strengthen disease surveillance and outbreak preparedness;
- Limited exchange of information between the human, animal and environmental health sectors and need to adopt the One Health Approach;

- Existing information products, which come in multiple formats appear to have limited dissemination and limited actionable insights and use in member states and could benefit from more focus on user needs and decision-making process; and
- Logistics Management Information Systems and Human Resources Information System could be important sources, but accessibility seems difficult due to data protection and would require intense country level stakeholder engagement.

The map below shows the Member States of IGAD and ECOWAS by geographical location.

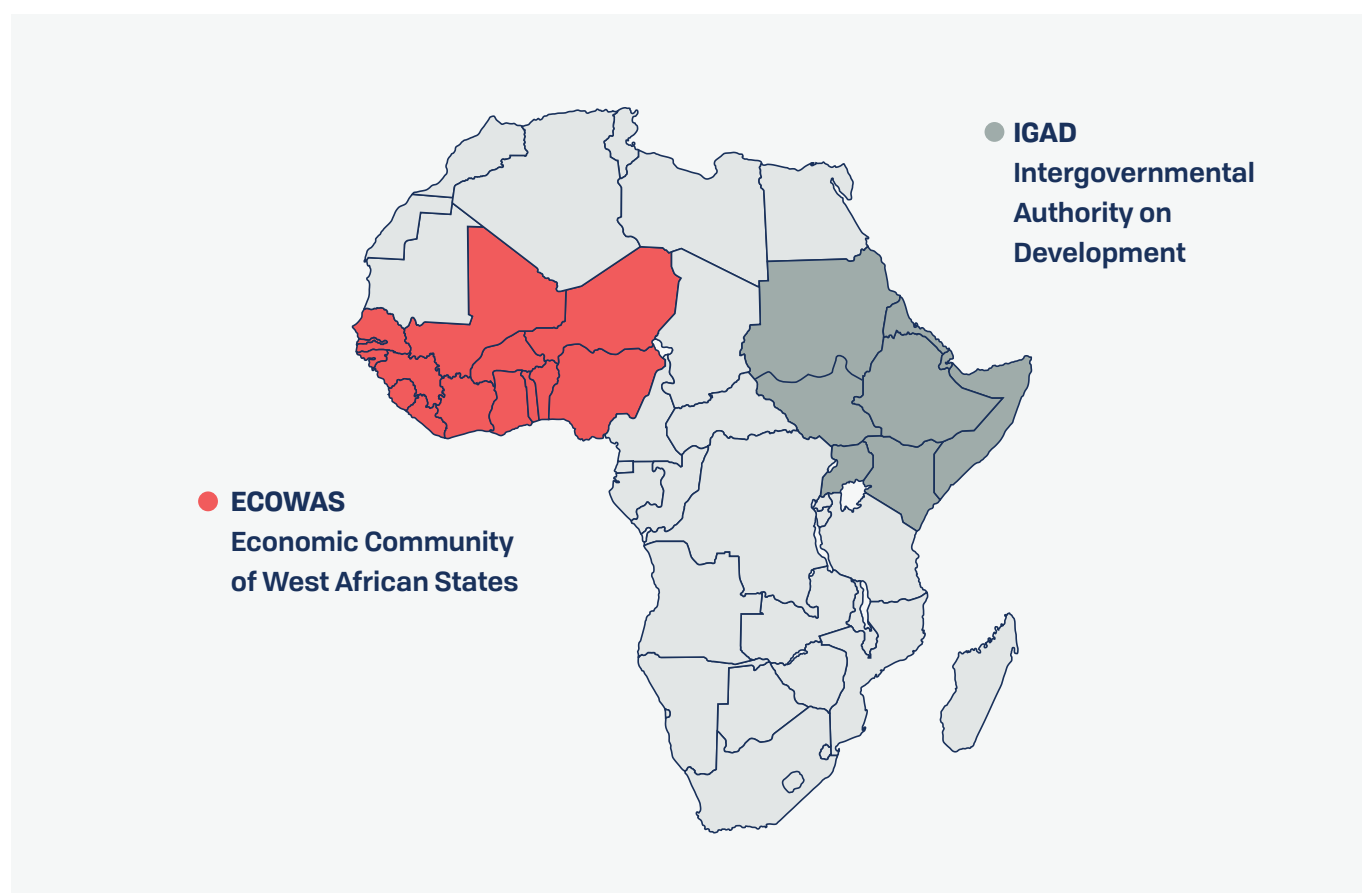


Figure 1: IGAD and ECOWAS Member States

ECOWAS Member States: Benin, Burkina-Faso, Cape Verde, Cote d'Ivoire, Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra-Leone, and Togo

IGAD Member States: Djibouti, Ethiopia, Kenya, Somalia, Sudan, South-Sudan, and Uganda

Three countries overlap between IGAD and EAC: Kenya, Uganda and South-Sudan

2. Landscape Analysis Overview

The goal of the year one landscape analysis was to produce a body of evidence that informs the future implementation of the RAD project.

The landscape analysis therefore sought to engage key stakeholders to define the problem that the RAD project will be solving, as well as conduct research that would provide insight and transparency into health data projects and systems across Sub-Saharan Africa. Doing so would enable the RAD project to identify critical gaps, learn from existing projects and initiatives, and ultimately, ensure that the implementation of the RAD project is both useful to stakeholders, as well as complementary to existing initiatives in the health data space.

The landscape analysis established that refugees are a key mobile cross-border population within the IGAD region, and this was emphasized by the teams at both the national and district levels within the Ministry of Health (MOH)-Uganda during the assessments. Uganda has been particularly affected by the refugee influx within the IGAD region. In the IGAD region, the influx of refugees into Uganda has continued with constant streams, with those from Democratic Republic of Congo (DRC) and South Sudan particularly overwhelming and stretching under-prepared and under-resourced health systems. UNHCR estimates (as at August-2017), that more than 898,864 South Sudanese refugees have been received in Uganda. Similarly, refugees from DRC already in Uganda as per UNHCR estimates (as at April-2017) were 227,413.

¹ <https://reliefweb.int/report/uganda/uganda-2017-refugee-humanitarian-needs-overview>

3. Landscape Analysis Methodology

The landscape analysis was designed to answer a range of questions, with a focus on the following core questions:

- What are priority health and health system problems at WAHO, IGAD and member state levels, with regards to maternal and child health (MCH) with a special focus on immunization; family planning (FP); Malaria; Tuberculosis (TB); and disease surveillance and response?
- How are policy decisions made that relate to these health priority areas? What data and information sources are currently used?
- What additional information is desired or might be useful to address these problems – in particular, which data from the region would be helpful?
- What additional potentially useful data sources exist?
- What health data or health information systems and interventions exist in multi-country settings and who runs them?
- What are the current policies and policy bottlenecks with regards to data and information sharing, use, and data security? What are policy success stories?
- How do health facilities in cross-border areas of interest collect, store, and communicate immunization and MCH health records?

To answer these questions and obtain additional insights for the design and implementation of RAD, a mixed approach of applied research and stakeholder engagement was used. Discussion guides and a questionnaire were specifically designed to answer these and related questions.

The stakeholder's engagements involved initial and follow-up meetings with the leadership and a range of professionals who work in the IGAD and WAHO headquarters in Djibouti and Burkina Faso. This was complemented with meetings and open-ended discussions with a range of international organisations and NGOs, as listed in the main section of the RAD Annual Report.

A desk review (mostly grey literature and sources accessible through the internet) helped to identify, classify and, to some extent, assess existing digital health initiatives, data sources, and information systems. The desk review was complemented with a small number of thematic key informant interviews to better understand the status of information systems and needs, specifically related to DHIS2, CRIS, and laboratory information systems.

Rapid site assessments to the pilot countries and cross-border regions/sites were planned as part of the landscape analysis. They were split in two by sub-regions and sub-purposes.

For the IGAD sub-region covering sub-purpose 2, in July 2017, the RAD team conducted site assessments in the cross-border region of the Tororo District in Uganda, visiting four public and one non-profit health care facilities.

The aim of the rapid site assessments was to document the realities of maternal child health / immunization services from the ground up and how this reality supports, refutes and/or supplements the information gained through the landscape analysis.

² The initial visits and interactions with WAHO and IGAD showed that the regional bodies (a secretariat, in the case of IGAD) cannot be understood in isolation from their national constituents. Their main aim is to fulfil the mandate they are given by their member states and to enable enhanced national-level actions and decision-making of sovereign states. From an early stage in the landscaping analysis, the needs of regional economic community (REC) member countries and the RECs themselves were therefore looked at in conjunction.

The rapid assessment interviews/group discussions were based around 6 themes:

1. Infrastructure availability at a facility level.
2. General facility level data collection processes and available tools (e.g. electronic or paper data, use of registers and/or individual folders, etc)
3. Facility level and referral patient workflows, particularly with regard to childhood immunisation
4. Routine immunisation practices, with a focus on data requirements
5. Mapping of immunisation services and referral flows in the immediate area around the facility
6. Local health seeking behaviours amongst women/carers for your children

For sub-purpose 1, rapid site visits and assessments were conducted in four countries in the ECOWAS and IGAD sub-regions: Uganda, Côte d'Ivoire, Ghana, and Togo. Additional complementary visits are planned for Kenya, Sudan and Ethiopia, in RAD Year 2. Each rapid assessment visit included semi-structured in-depth interviews with 10-15 national-level stakeholders from the Ministry of Health and, as possible, key informants in the Ministries of Agriculture and Environment, National Statistical Agencies, and international partner organisations or projects, including WHO, CDC and World Bank. In addition, the assessment in Uganda included visits to health facilities in the border region, and interviews with facility staff and sub-national health management teams, to gather information related to the implementation of the client-provider level digital solution. Sub-national and facility level visits will also be conducted in the Kenya, Ethiopia and Sudan country assessments.

With few exceptions, all key informant interviews were audio-recorded and transcribed. A few participants preferred that written notes are taken. For the analysis, the transcripts were then summarized and coded in a spreadsheet based on principles of applied qualitative research. The findings were written up in this overall paper, as well as separate reports for regional data use, client-provider solution, and policy analysis.

Finally, a Digital Health Project Map which represents an online version of all findings from the Year 1 landscape analysis, in terms of digital health projects and initiatives that are being implemented across Sub-Saharan Africa and of relevance to the RAD project will be developed. The system will be designed to allow for the easy dissemination of the content to other interested stakeholders. It will subsequently incorporate national level health and economic data for the purposes of contextualizing the data that had been collected during the landscape analysis concerning digital health projects and initiatives. The Digital Health Map will be updated on an ongoing basis with data from new digital health initiatives and new developments on existing one.

The landscape analysis was conducted as formative research, representing individual perspectives of the stakeholders engaged, to inform the design and implementation of the RAD project in subsequent years. Validation of the findings collected during the landscape analysis was done with the relevant stakeholders at the national and sub-national levels; to foster support and buy-in for the project.

4. Landscape Analysis Results

4.1 Sub-Purpose One

4.1.1 User Needs

Regional Level

WAHO: In the WAHO region, the RAD team conducted a series of high level stakeholder engagements to reach an agreement on the year two focus, as well as WAHO's priority health area. Together, WAHO leadership and the RAD team agreed that WAHO's year two focus will be on the development of a regional level solution, and that the priority health area would be support for WAHO's disease surveillance goal, which aims to provide easy access to high quality health information for member states, for improved decision making at all levels within the ECOWAS region.

WAHO's regional needs therefore include:

1. support in developing the capacity required to aggregate data from disparate sources at the regional level, and
2. support for the improved development, dissemination, and utilization of health information

Specifically, WAHO's regional needs require RAD to support the integration of disparate data sources within the region into a regional data analytics platform, and the subsequent development and dissemination of an enhanced weekly epidemiological bulletin, quarterly health bulletin, as well as an annual regional health profile.

IGAD: The priority health area identified through several stakeholder engagements with IGAD was maternal, neonatal and child (MNCH), with an initial emphasis on immunization within cross-border mobile populations, including pastoralists.

At a regional level, IGAD's needs include the development of a regional analytics platform, for analysing aggregate, high-level data to inform decision making related to immunization and MNCH. IGAD leadership and the RAD team agreed that this regional focus will be explored at a later stage in the project.

National Level

Data and Information Quality: Due to the framing of the discussion, many of the challenges that interview participants during the country visits described were related to data and information use. Insufficient data quality to be a solid source for decision making, and to have the full trust of decision-makers, was mentioned in all countries in ECOWAS. There are many reasons that contribute to the situation, including the heavy workload of health workers, half-hearted data validation at the intermediary levels, insufficient resources to carry out comprehensive supervision or data validation on the ground, lack of infrastructure in health facilities including district hospitals and laboratories (electricity, internet, computers), and lack of human resources.

The expertise to set up laboratory information systems, write policy briefs, or generate reports based on DHIS2 in a quick manner were among the skills that were cited as needing reinforcement. With regards to research, skills needed included the identification of relevant research questions (Ghana, Togo), better dissemination of research findings (Ghana), and the more generally to understand the landscape of health research in the country in terms of key actors and ongoing operational research.

A district hospital in Uganda shared the experience of trying to set up an EMR, a project that was later abandoned, and in Ghana, a cancer registry had been set up and later “collapsed”. For family planning, the data available was said to be generally insufficient (Ghana) and maternal mortality is often underreported. For immunization, a problem all countries face are incorrect population denominators, which leads to unreliable immunization coverage indicators, often above 100%. All these factors lead to a situation where decision-makers do not fully trust the data obtained from routine health information systems.

Key Challenges by Health Domain: Maternal and Child health emerged very high on the list of priorities of the overall leadership in all countries. In Uganda and Côte d'Ivoire, top leaders insist on reviewing situation reports on a regional basis, and in both countries, concrete measures have been taken to address maternal mortality which were very much driven by the data. The key challenges and priorities by health domain (as per the RAD funding baskets + surveillance) are listed in the table below. It is important to note the director for each of the domain areas could not be interviewed in all the countries; therefore, challenges quoted for one country might also apply to other countries.

The tables below (table 1 and 2), show the challenges identified categorized according to health domains and WHO health systems building blocks.

Table 1: Key Challenges by Health Domain³

Health Domain	Key Challenges Cited
Immunization	<ul style="list-style-type: none"> • Continuity of vaccine supply, avoidance of stock-outs • Cold chain completeness, maintenance and repair • Lack of resources for immunization outreaches • Population groups who actively avoid immunization
Maternal and child health	<ul style="list-style-type: none"> • High rate of maternal and perinatal mortality • Behaviour: Population misses recommended ANC visits • Stock-outs of essential medicines • Lack of emergency medical care in health facilities • Lack of blood supplies in health facilities • Malnutrition
Reproductive health	<ul style="list-style-type: none"> • Low utilization of contraceptives • Managing continuous supply of contraceptives
Disease control (TB, Malaria)	<ul style="list-style-type: none"> • TB Case finding • Equipment and Logistics • Insufficient emphasis on vector control (Malaria/CI) • Insufficient data due to low number of sentinel sites (Malaria/CI)
Disease surveillance	<ul style="list-style-type: none"> • Data completeness at the district level • Lack of time/expertise to carry out risk mapping • Cost of scaling up pilot digital data interventions • Outbreaks in neighbouring countries • Difficult to get data from very remote areas (Uganda) • Non-mediated but dangerous diseases cases, especially highly drug resistant pathogens, are not given required attention, as opposed to illnesses such as avian flu, polio or Ebola. • Low scores in JEE assessments in certain areas • Lack of integration of animal and human surveillance
Cross-cutting	<ul style="list-style-type: none"> • Tracking of financial resources as a basis to understand costs and budgeting • Introduce or improve community health schemes • Lack of coordination and duplication of donor-funded projects • Management of medicine supplies⁴

³ Additional findings from Kenya, Ethiopia and Sudan country assessments will be added in Year 2.

⁴ In Uganda, the “influx” of population from neighbouring countries was described as a challenge that made it difficult for facilities in border regions to plan their drug stock and requisitions well, leading to stock-outs.

Table 2: Key challenges identified, by WHO Health Systems Building Block

Health System Building Block	Challenges Identified
Information	<ul style="list-style-type: none"> • Data completeness at the district level • Cost of scaling up pilot digital data interventions • Difficult to get data from very remote areas (Uganda) • Data quality and reliability (IDSR, Immunization) • Insufficient data due to low number of sentinel sites (Malaria) • Lack of integration of animal and human surveillance
Financing	<ul style="list-style-type: none"> • Tracking of financial resources as a basis to understand costs and budgeting • Lack of resources for immunization outreaches • Lack of coordination and duplication of donor-funded projects
Human Resources	<ul style="list-style-type: none"> • Lack of skills for emergency medical care in health facilities • Lack of time/expertise to carry out outbreak risk mapping
Medicines and Technologies	<ul style="list-style-type: none"> • Continuity of vaccine and contraceptive supply • Cold chain completeness, maintenance and repair • Stock-outs of essential medicines for MCH • Management of medicine supplies

Decision mechanisms and processes: A common setting for discussions and consensus-building are regular review meetings. Such meetings happen on a weekly basis (for example weekly disease surveillance review meetings), a monthly basis (for example departmental meetings) a quarterly basis (for example programmatic reviews on immunization, Malaria or TB, or HIS data quality), and on an annual basis for strategic reviews, planning and budgeting. Quarterly and annual reviews often involve stakeholders from different administrative levels. Ghana has an innovative plan to set up regular district peer-review meetings. During such routine gatherings, data, progress reports and experiences are usually presented by participants with PowerPoint presentations.

During emergencies and disease outbreaks there are standard mechanisms in place to share information and coordinate the response across stakeholders. Uganda has a permanent Emergency Operations Centre that monitors diseases on an ongoing basis; Togo has a multi-sectorial emergency response mechanism, and several countries have completed a generic emergency response plan.

Periodic national health sector strategic plans (5-year plans), and the annual workplans have an important influence on activities and the framing of priority problems in the health sector albeit more on the strategic than on the operational level. Such decisions are also influenced and sometimes determined by regional and global policies or regulations.

Apart from these standard processes and tools for planning, the typical decision-making processes described in the various countries varied, as shown in the table on page 12 (Table 3).

Table 3: Decision-making processes by country

Country	Description
Côte d'Ivoire	Technical specialists and working groups prepare inputs and recommendations, which are passed to the General Inspector. The final decision is typically made by the Minister of Health after discussions with the cabinet.
Ghana	The annual National Health Summit organized by Ghana Health Services plays an important role in priority-setting and resource allocation. It brings together all regions of the countries as well as partners. Health and service indicators are reviewed and discussed, as well as challenges that warrant in-depth assessments. Experiences with new approaches are also shared at the summit. International development partners have signed an MoU to adhere to decisions made during the summit for programme implementation. The Ministry of Health reviews monitoring and evaluation indicators of the strategic plans at the end of every year and makes strategic decisions for the next year based on findings from this review.
Togo	The progress of health programmes, such as the reproductive health programme, are reviewed on a periodic basis (e.g. bi-annually) by a M&E committee. Other details about an organized decision-making process did not emerge clearly from the interviews in Togo, although there was a general sense that the use of evidence is still limited.
Uganda	<p>Uganda has institutionalized a participative process of decision making that starts at the technical level before it reaches management and political levels. The process typically follows the following pathway:</p> <p>Discussion in technical working groups</p> <ul style="list-style-type: none"> • Technical department review and approval • Senior management review and approval • Partners' Advisory Committee for review • Top management review and endorsement • Discussion by cabinet, parliament (if applicable) <p>Along the way, there are also formal or informal consultations with interested stakeholders, such as technical groups from other related sectors, the civil society coalition, and the private health sector organisation. These consultations are important to enable a smooth implementation process once a change has been adopted.</p>

The use of evidence for decision-making: A key role of data is its use across different health programmes is to motivate or justify the allocation of resources, be it financial or in the form of health service inputs. A common way of using data for resource mobilization is to first determine the financial "gap" and then discuss with government and financial partners how the gap can be closed.

Data is also used routinely to provide situation updates, especially in the case of disease and maternal deaths surveillance. Interview participants explained that it is typically not the senior managers themselves who access data or information directly from a source file or information system, but they ask someone in their team – for example, someone from the HIS department or from disease surveillance – to prepare a brief and share in a printed or digital format.

Several concrete examples were given about the current and past practice of using evidence for decision making, which are listed in the table 4 below.

Table 4: Examples of using evidence for decision-making

Country	Description
Côte d'Ivoire	<ul style="list-style-type: none"> Challenges in health service provision are communicated from the ground upwards towards the centre and influence the decisions taken. The decision-making process typically starts with an identification of gaps (based on internal research in the department of planning) and evaluation of possible solutions. The Minister of Health reviews a situation analysis of maternal mortality every month. An analysis of maternal mortality data by geography and causes of death has guided the designer of a targeted intervention to train midwives.
Ghana	<ul style="list-style-type: none"> Research agenda by GHS is informed by the outputs of annual reports from DHIS2 and disease control programmes. Ministers and other key stakeholders are involved from the very outset in the design of new studies to make them more useful. Decisions are informed by internal desk-research.
Uganda	<ul style="list-style-type: none"> Funding allocation in maternal health and other health areas is prioritized based on information from scorecards, performance reports and maternal and perinatal death surveillance activities The "Sharpen" plan for maternal and child health prescribed the analysis of data to allow resource allocation based on geographic mortality levels, high-burden populations, resource mapping and resource tracking. The Minister of Health reviews a hard-copy dashboard of the health situation, including maternal mortality, every week.
Togo	<ul style="list-style-type: none"> The current health sector strategic plan was developed based on data reviews Hard-copies of 2015 statistical yearbook and a booklet with findings of last National Health Accounts was encountered on desks in Ministry of Health
All Countries	<ul style="list-style-type: none"> Mid-term health sector strategic plans (and sub-sector strategies) are developed based on a review of data and evaluation indicators Indicator surveys (DHS, MIC, STEP etc.) play as an important reference source for decision-makers to understand the situation in the country

Challenges related to the use of evidence for decision-making: The annual budget cycle imposes limits on the flexibility of making decisions, because the budget must be signed off much in advance and then leaves little flexibility for modification. There are situations where budgetary ceilings do not allow optimal action, as illustrated in an example provided in Côte d'Ivoire, where the quarterly budget ceiling did not allow for optimal procurement and supply management of vaccines. After presenting to her counterpart in the Ministry of Finance the right data, however, the person in charge could achieve an increase in the ceiling which helped the country optimize the supplies and save money.

In all visited countries, interview participants recounted the experience that not everyone sees an equal importance and utility in using data for decision making. They suggested that sensitization and advocacy for the use of evidence is still important. In Ghana, a participant explained that dashboards and scorecards may not be utilized enough, since there is no system that forces people to look at them.

Political pressures, the media, public opinion and popular beliefs often influences decisions more than evidence. Furthermore, the urgency of a matter at hand and the amount of time a decision maker (or institution) has impacts the use of evidence. In Ghana and Uganda, participants highlighted that at the health facility level, data is rarely used for decision making - mostly because health workers do not have time (nor the tools) to analyse data and apply insights.

Information Products: The country visits did not aim to systematically identify publications and information products, but several different approaches in which information is reported were mentioned by the stakeholders. The use of these tools varies widely between countries. In Uganda, there appears to be a more extensive use of performance indicators in the form of scorecards than elsewhere; a weekly epidemiological bulletin is established in many countries but was not being published in Togo at the time of the visit. Maternal mortality was reported through situational updates to top leadership in both Côte d'Ivoire and Uganda.

4.1.2 Existing Information Products

Sub-purpose 1 involves developing a regional data and analytics solution for information generation and dissemination. It was therefore pertinent to investigate and understand existing information products that aggregate and analyse data for information generation and dissemination.

Weekly Epidemiological Bulletins

Findings related to weekly epidemiological bulletins are based on a review of Ministry of Health and WHO websites, combined with further online searches and document reviews, as well as several key informant interviews with professionals in national disease surveillance and global health security.

Weekly epidemiology bulletins provide an overview of national and district level epidemiological indicators. They are typically produced by Disease Surveillance and Response units in the Ministry of Health. The bulletins serve as a feedback to health authorities at the sub-national level and can be a source of information for organizations involved in pandemic response, regional bodies and neighbouring countries. For these stakeholders to be able to assess the effectiveness of a response in case of an outbreak and consider their own action, the weekly reports need to be published on time, and in addition to suspected and confirmed cases of a pathogen, they should provide case fatality and attack rate data at the subnational level.

In the case of a suspected or confirmed outbreak, decision makers need to rapidly make decisions about the deployment of resources for local investigations, activation of response teams, and allocation of resources to districts based on a presumed level of need. Key metrics that can influence these decisions include the attack rate, accessibility of the location, number of local facilities as well as their level of staffing, service availability and supply stocks, vaccination rates, population density, population disease awareness and behaviour, and the trend in the number of cases and disease spread.

All countries in the WAHO and IGAD regions use some form of IDSR disease surveillance reporting system and send regular data to the WHO's Outbreaks and Emergencies unit, however, data frequency, accuracy and coverage varies. However, data from border districts passes only to the national Ministries of Health, and only goes directly from district to district (through cross-border meetings) in cases of confirmed outbreaks or emergencies.

Relatively few countries make their national weekly epidemiology reports publicly available. As information products, there is also varied usage of data visualization techniques to enhance the interpretation of the data, with some reports overly reliant on data tables.

- 6/22 WAHO and IGAD countries currently make weekly epidemiology reports publicly available, which were up to date at the time of review and appear to be published routinely. These included Mali, Nigeria, Liberia, Sierra Leone, Uganda and South Sudan.
- Other countries, such as Ghana, have published weekly epidemiology bulletins in the past, or have links that should lead to current weekly bulletins. However, these links are either broken or the bulletins have not been updated.
- There does not seem to be a common template to report results; the analytics are primarily descriptive; and some countries make limited or no use of basic data visualization tools like time series line graphs, outbreak maps and flagging of outlying results.
- Generally, the number of confirmed cases is presented together with a case fatality rate (CFR). However, it is less common to see figures on attack rate for outbreaks.

Periodic Health Bulletins and Profiles

There are many existing information products from WHO, NGOs, national governments etc. in Sub-Saharan African. These reports either focus on program specific areas, or on high level national health outcomes. Many of these reports use visualization techniques such as sub-national mapping, time series and comparative analytics.

While there are reports that are based on primary data sources, there are also a multitude of stakeholders that re-use data to produce different information products. Some of these have interesting new approaches or have a specific focus on an area missed by the primary source, such as the Health Financing Reports (Health Policy Project,) which uses data from the WHO National Health Accounts with primary research to look in greater depth at health financing trends. Many others restate or aggregate existing information without adding anything substantially different.

Malaria and TB have a standard template for reporting in the WHO Malaria and TB country profiles. However, there appears to be no standard reporting template for MNCH and FP country profiles, though MNCH has several parallel and overlapping reports available. Reporting for FP is generally weaker than for Malaria, TB and MNCH. The existing FP country reports identified in the desk research use data based on periodic household survey data from the DHS surveys, combined with descriptive analyses.

The provision of regularly updated country health profiles is a mandate of WAHO by its member states. WAHO have, therefore, recently started to publish quarterly health reports as part of the WARDS (West African Regional Disease Surveillance) project and disseminate an annual health profile report. The primary purpose of the annual report, as envisioned by WAHO, is to enable countries to monitor their progress, identify areas for improvement, and learn from the experience in other countries in the region. According to discussion with WAHO technical staff, existing reports are partially based on standalone surveys that are conducted infrequently and at different times in different countries or are simply not updated often enough. Some reports lack standardization that would allow a comparison between countries and many have limited sub-national granularity. Where routine data exists, a consolidated regional overview and comparison is not yet available. Thus, it is difficult to identify health budget priorities and needs for geographical focus based on the health burden or health system gaps.

Looking at the frequency of the data updates, Disease Surveillance, TB and MCH all have regular updates, generally reporting is annual and most of the data can be pulled directly from DHIS 2, supplemented in some cases with survey data. For malaria, it is only the incidence rate that has regular updates, while use of bed nets relies on census and survey data [Demographic Health Survey (DHS) and Malaria Indicator Survey (MIS)] every 3-5 years. Lastly, according to WAHO, Family planning data updates are the most infrequent, with updates through census and survey data occurring every 3-5 years. Most of the sources appear to be accessible for inclusion when developing the annual country health profiles, with cooperation from WAHO and the member states.

When country-level stakeholders were asked about content that they would expect to see in regional health bulletins, some respondents suggested that reports should not only present aggregate or outcome indicators but also provide measures of the process indicators (health governance), while others would prefer to see more granular regional epidemiological data, going as low as district level.

Below are some of the suggestions in information content that interview participants made for regional health bulletins:

- Information about the number, quality, and distribution of health personnel.
- Environmental health indicators, which are invariably predictors of health.eg. air (carcinogenic contaminants), water (percentage of pesticides in water), soil (pollution, concentration of pesticides), etc.
- Tips and practices for appropriate population behaviour (communication messages) during epidemic outbreaks and more broadly healthy lifestyle
- Best practices of health system governance and service delivery within each country and sharing of strategies that have worked.
- Laboratory reagent stock outs as these are directly related to the ability to respond to an epidemic. Additionally, in the case of an epidemic, this information will make it easier to know which neighbouring country has enough stock so that extra emergency stock may be procured.
- The contents of the bulletin must be aligned with each country's national health strategic plan.
- The bulletins must share medicines supply management, information on communicable and non-communicable diseases such as hypertension, diabetes, prostate, cervical and breast cancer.
- Emergency management.
- Surveillance results and actions taken

Existing information products relevant to sub-purpose 1

Table 5: Existing information products relevant to sub-purpose 1.

Solution	Countries	Thematic Area	Partner
WAHO weekly epidemiological bulletins	West Africa	Disease Surveillance	WAHO
WAHO quarterly health bulletins	West Africa	Malaria, MNCH, FP & TB	WAHO
WAHO annual health profiles	West Africa	Malaria, MNCH, FP & TB	WAHO
WHO weekly epidemiological bulletins	Sub-Saharan Africa	Disease Surveillance	WHO
WHO statistical profiles	Sub-Saharan Africa	Malaria, MNCH, FP & TB	WHO
WHO malaria country profiles	Sub-Saharan Africa	Malaria	WHO
WHO Tuberculosis country profiles	Sub-Saharan Africa	TB	WHO
African Health Stats	Sub-Saharan Africa	Malaria, MNCH, FP & TB	AU
Global burden of disease country profiles	Sub-Saharan Africa	Malaria, MNCH & TB	IHME
Health-related SDG country profiles	Sub-Saharan Africa	Malaria, MNCH, FP & TB	IHME
Countdown 2030 MNCH country profiles	Sub-Saharan Africa	MNCH	Countdown
GAVI country profiles	Sub-Saharan Africa	MNCH	GAVI
HealthMap	Sub-Saharan Africa	Disease Surveillance	Harvard

WAHO weekly epidemiological bulletins: WAHO publishes a weekly update on epidemic-prone diseases in the form of a bulletin. The weekly epidemiological bulletin is generally a one-page, succinct document, which pulls in data from the DHIS2 systems of the ECOWAS countries, and presents data, in the form of bar graphs, line charts and tables, for the most important outbreaks in the region. The weekly epidemiological bulletin also reports on the completeness of weekly reports per country, in terms of the number of reports received per country and contains a text description (in French) of all the data presented as visualizations within the bulletin. Discussions with key stakeholders during the site visit in Ivory Coast suggest that the WAHO weekly epidemiological bulletin is not well known and disseminated within all countries.

WAHO quarterly health bulletins: WAHO recently started to publish quarterly epidemiological bulletins as part of the WARDS (West African Regional Disease Surveillance) project. The quarterly health bulletins pull in data from the DHIS2 systems of ECOWAS countries and presents the overarching trend data for the most important outbreaks in the region. Data visualisations are generally time series line graphs and tables of cases by country. Data accompanies by descriptive text on the situation on the ground. After a general overview of recent developments, the Report is divided by epidemic disease area, focussed on communicable disease trends. In addition, it has a short non-surveillance thematic section at the end that changes in every quarter, for example on One Health or on Health Information Systems.

WAHO annual health profiles: The provision of regularly updated country health profiles is a mandate of WAHO by its member states. The primary purpose of the annual reports, as envisioned by WAHO, is to enable countries to monitor their progress, identify areas for improvement, and learn from the experience in other countries in the region. The “WAHO Guideline of Tracers Health Indicators” and an accompanying excel document describe a range of proposed health indicators that were listed by WAHO for the monitoring of health and health systems across ECOWAS states. Of the metrics (82) proposed for possible inclusion in the annual country profiles, 17 are disease surveillance metrics, 19 are for MNCH, 3 are focused on TB, 4 on FP and 3 on malaria. The rest are either demographic (7), finance (5), human / health system resources (13) or HIV (6) focused.

Looking at the frequency of the data updates, disease surveillance, TB and MCH all have regular updates. Generally reporting is annual and most of the data can be pulled directly from DHIS 2, supplemented in some cases with survey data. For malaria, it is only the incidence rate that has regular updates, while use of bed nets relies on census and survey data every 3-5 years. Lastly, according to WAHO, Family planning data updates are the most infrequent, with updates through census and survey data occurring every 3-5 years. Most of the sources appear to be accessible for inclusion when developing the annual country health profiles, with cooperation from WAHO and the member states.

WHO weekly epidemiological bulletins: The WHO weekly epidemiological bulletin on Outbreaks and Other Emergencies (OAE) is a well-established product for regional sharing of disease surveillance and response information. The WHO OAE complements epidemiological data with additional information related to food insecurity, flood patterns, migration data and waterways, generally individual country bulletins do not. The WHO AFRO OAE bulletin is generally around 14-15 pages long, covers the sub-Saharan African region excluding Somalia, Djibouti and Sudan with data about selected acute public health emergencies, and is published every Friday. Somalia, Djibouti and Sudan are part of the WHO EMRO region which extends from Morocco in the West to Pakistan in the East. The WHO EMRO office publishes the Weekly Epidemiological Monitor, a one-page publication on disease outbreaks and threats across the region⁵.

WHO statistical profiles: The WHO statistical profile is created for every country worldwide in a common format. Reports derived from predominantly WHO global health observatory data and includes data on basic healthcare metrics such as, population and life expectancy, millennium development goal metrics, immunisation

⁵ The WHO Global Polio Eradication Initiative has a Horn of Africa Office in Nairobi which monitors data related to polio across the WHO regional borders in East Africa.

coverage and under-5 mortality. The WHO Statistical Profile contains data visualisations from the Global Burden of Disease database looking at causes of mortality, disability and epidemiology for both communicable and non-communicable diseases. Many of these datasets represent the best estimates of WHO using methodologies for specific indicators that aim for comparability across countries and time.

WHO malaria country profiles: The WHO Malaria country profiles are available for all 91 endemic countries. The reports are generated automatically using data from the WHO Global Health Observatory database, which itself is supplemented by data from national household surveys and databases held by other organizations. The DHS Malaria Indicator Surveys are a critical component in data collection, but these are periodic not continuous. In addition to country reports there is also the World Malaria Report, released each year in December. The WHO Malaria country profiles are the only reports to systematically use subnational data to map confirmed cases by county and Plasmodium Falciparum Parasite Prevalence. The WHO Malaria country profiles contain data visualisations on financing, coverage, impact in cases treated, mortality and epidemiology. Information on interventions and policy positions delivered in table format.

WHO tuberculosis country profiles: The WHO tuberculosis country profiles are available for all countries and generated automatically based on data reported by countries, which are held in WHO's global TB database. Countries can update information at any time via WHO's TB data collection system. The WHO tuberculosis country profiles contain data tables on TB incidence, mortality, notifications, HIV status and drug resistance, and provides data visualisations on treatment success rates, finance, mortality and epidemiology. Prior to the creation of the TB Country Profiles, the Stop TB program created a series of country profiles. These profiles had interesting financial breakdowns that did not make it into the WHO reports.

African Health Stats: African Health Stats is an innovative online data platform of the African Union Commission's Department of Social Affairs and is part of the CARMMA campaign. The platform allows users chart, map and compare key health indicators across all 54 African Union member states. The African Health Stats platform aggregates data from officially-recognised international sources, such as WHO, UNAIDS, UN Child Mortality and the Millennium Development Goals Indicators. The platform is updated annually but lacks uniformity in terms of the years that data is displayed between countries.

Global Burden of Disease Country Profiles: The Global Burden of Disease Country Profiles have been created by the Institute for Health Metrics and Evaluation (IHME), which is an independent global health research centre at the University of Washington. The country profiles provide an overview of findings from the Global Burden of Disease (GBD) study. The country profiles are based on over 115,000 different data sources used by researchers to produce the most scientifically rigorous estimates possible. The interactive tool allows for analysing updated data about the world's health levels and trends from 1990 to 2016, using tree maps, maps, arrow diagrams, and other charts to compare causes and risks within a country, compare countries with regions or the world, and explore patterns and trends by country, age, and gender. The tool allows for drilling down from a global view into specific details and comparing expected and observed trends. With the tool, one can watch how disease patterns have changed over time and see which causes of death and disability are having more impact and which are waning.

Health-related Sustainable Development Goals Country Profiles: The Health-related Sustainable Development Goals (SDG) Country Profiles explore progress toward achieving the United Nations SDGs. The country profiles are designed to spur improvements in health, equity, and overall well-being by 2030 in countries at all levels of development. Users can explore improvements made by 188 countries from 1990–2016 toward 37 health-related SDG indicators, such as the mortality rate due to road injuries, prevalence of intimate partner violence among women, maternal mortality ratio, and incidence rate of new HIV infections. Further, users can examine potential trajectories for these indicators through 2030, as shown by projections based on past trends. Users can view gains on the overall health-related SDG, MDG, and non-MDG index, as well as for each SDG

indicator, by country (with and without uncertainty), or by global map (with and without percentage change over time). Users can also compare the relationship between SDG indicators and measures including the Socio-demographic Index (SDI).

Countdown 2030 MNCH Country Profiles: The Countdown country profile presents in one place the best and latest evidence to enable an assessment of a country's progress in improving reproductive, maternal, new-born, and child health (RMNCH) and achieving the Sustainable Development Goals (SDGs). Each profile presents the most recent available information on selected demographic measures of maternal, new-born, and child survival and nutritional status, coverage rates for priority interventions across the continuum of care, and selected indicators of equity, policy support, human resources, and financial flows.

GAVI country profiles: GAVI produces individual country reports on their activities. The reports are largely focused on the financial contributions made by GAVI and where money has been spent. There is an analytic description of expected immunisation coverage and some key maternal mortality metrics on each report but the amount of information by country is limited.

HealthMap: HealthMap is an established global leader in utilizing online informal sources for disease outbreak monitoring and real-time surveillance of emerging public health threats. The freely available Web site 'healthmap.org' and mobile app 'Outbreaks Near Me' deliver real-time intelligence on a broad range of emerging infectious diseases for a diverse audience including libraries, local health departments, governments, and international travellers. HealthMap brings together disparate data sources, including online news aggregators, eyewitness reports, expert-curated discussions and validated official reports, to achieve a unified and comprehensive view of the current global state of infectious diseases and their effect on human and animal health. Through an automated process, updating 24/7/365, the system monitors, organizes, integrates, filters, visualizes and disseminates online information about emerging diseases in nine languages, facilitating early detection of global public health threats.

4.1.3. Relevant Projects and Initiatives

A central characteristic of the RAD project, and the purpose of the landscape analysis, is to understand the context in which the RAD project will be implementing solutions, to learn from and complement existing initiatives. It was therefore pertinent to investigate and understand the existing projects and initiatives within Sub-Saharan Africa, with a focus on East and West Africa. Such projects and initiatives can be found in the table below.

Table 6: Existing projects and initiatives relevant to sub-purpose 1.

Projects and Initiatives	Region	Thematic Area	Partner
Health Emergencies Program	Sub-Saharan Africa	Disease Surveillance	WHO
Integrated Disease Surveillance and Response Initiative	Sub-Saharan Africa	Disease Surveillance	WHO
Global Health Observatory	Sub-Saharan Africa	Malaria, MNCH, FP & TB	WHO
Institutional Repository for Information Sharing	Sub-Saharan Africa	Malaria, MNCH, FP & TB	WHO
Global Strategy for Women's, Children's and Adolescents' Health (2016-2030)	Sub-Saharan Africa	MNCH	WHO
Global Health Security Agenda	Sub-Saharan Africa	Disease Surveillance	Multiple Partners
Africa CDC	Sub-Saharan Africa	Disease Surveillance	African Union with technical assistance from US CDC

Projects and Initiatives	Region	Thematic Area	Partner
Preparedness and Response Program	Sub-Saharan Africa	Disease Surveillance/ One Health governance	DAI
Regional Disease Surveillance Systems Enhancement Project	West Africa	Disease Surveillance	WAHO
ECOWAS Regional Centre for Disease Control	West Africa	Disease Surveillance	WAHO
West African Health Information Team	West Africa	Disease Surveillance	Health Policy Plus
Sahel Malaria and Neglected Tropical Diseases	West Africa	Disease Surveillance	WHO/APOC
Regional Programme Support to Pandemic Prevention in the ECOWAS Region	West Africa	Disease Surveillance	GIZ
The Epidemiological Surveillance Network of West African National Public Health Institutes	West Africa	Disease Surveillance	AMP
Emergency Management program	West Africa	Disease Surveillance	eHealth Africa
WAHO-CAPS Project	West Africa	Capacity Development	WAHO
Maternal Death Surveillance and Response Initiative	Sub-Saharan Africa	MNCH	WHO
Campaign on Accelerated Reduction of Maternal, New-born & Child Mortality in Africa	Sub-Saharan Africa	MNCH	AU
Countdown 2030 Initiative	Sub-Saharan Africa	MNCH	Countdown
Sahel Women's Empowerment and Demographic Dividend project	West Africa	Family Planning	UNFPA
Project Démographie et santé sexuelle et de la Reproduction	West Africa	Family Planning	WAHO
Systems for Improved Access to Pharmaceuticals and Services Program	East & West Africa	Malaria, MNCH, FP & TB	MSH
East Africa Public Health Laboratory Networking project	East Africa	Disease Surveillance	N/A
Medicines Regulatory Harmonization	East Africa	Supply Chain	IGAD/WAHO
Cancer Centre of Excellence	East Africa	Non-communicable disease (NCD)	IGAD
Drought Disaster Resilience Sustainability Initiative	East Africa	Climate	IGAD
Initiative for Systematic Data Sharing Arrangement among Statistics Agencies	East Africa	M&E	IGAD
Global Fund Project	East Africa	TB and HIV	IGAD
BlueSquare	East & West Africa	Health Information Systems	BlueSquare
African Population and Health Research Centre	East & West Africa	MNCH, FP, & NCDs	APHRC
International Development Research Centre	East & West Africa	MNCH	IDRC
Health Data Collaborative	East & West Africa	Health Data	N/A

Health Emergencies Program: The WHO Health Emergencies Program is designed to address all hazards flexibly, rapidly and with a principle of 'no regrets'. It works synergistically with other WHO programmes and partners to address the full cycle of health emergency preparedness, response and recovery in support of local community and national government efforts. It encourages full participation and integration of all partners and operates with clear accountability and standard performance metrics. It consolidates and expands WHO's existing capacities at country, regional and headquarter levels, and leverages the unique governance structure of WHO. The Health Emergencies Program follows deliberations of the Executive Board in January 2016, the Director General, Deputy Director-General and Regional Directors of WHO, after which a statement was issued committing to urgently reform the emergency work of WHO in a comprehensive way "through the establishment of one single programme, with one workforce, one budget, one set of rules and processes and one clear line of authority" and "an independent mechanism of assessment and monitoring of the performance of the Organization, reporting to the governing bodies".

Integrated Disease Surveillance and Response Initiative: The Integrated Disease Surveillance and Response (IDSR) initiative provides a framework for strengthening the surveillance, response, and laboratory core capacities required by the revised International Health Regulations (2005). Of the 46 countries in the World Health Organization (WHO) African region (AFRO), 43 are implementing IDSR guidelines to improve their abilities to detect, confirm, and respond to high-priority communicable and noncommunicable diseases.

Global Health Observatory: The Global Health Observatory (GHO) is WHO's gateway to health-related statistics for its 194 Member States. The aim of the GHO portal is to provide easy access to:

- country data and statistics with a focus on comparable estimates;
- WHO's analyses to monitor global, regional and country situation and trends.

GHO theme pages cover global health priorities such as the health-related Millennium Development Goals, mortality and burden of disease, health systems, environmental health, noncommunicable diseases, infectious diseases, health equity and violence and injuries. The theme pages present:

- highlights showing the global situation and trends, using regularly updated core indicators;
- data views customized for each theme, including country profiles and a map gallery;
- publications relevant to the theme;
- links to relevant web pages within WHO and elsewhere.

The GHO database provides access to an interactive repository of health statistics. Users are able to display data for selected indicators, health topics, countries and regions, and download the customized tables in Excel format. The GHO country data includes all country statistics and health profiles that are available within WHO. The GHO issues analytical reports on priority health issues, including the World Health Statistics annual publication, which compiles statistics for key health indicators. Analytical reports address cross cutting topics such as women and health.

Institutional Repository for Information Sharing: The Institutional Repository for Information Sharing (IRIS), created in 2012, enables more people to access WHO's information products. IRIS is the multilingual digital library of WHO, providing free access to the full text of WHO information products in the six official languages. More than 50 000 documents are currently available, and the number is increasing rapidly with the addition of many collections, such as the entire historical set of governing bodies documentation from 1948 onwards. IRIS is recording more than 1.5 million downloads per month and will soon be available as a mobile app.

Global Strategy for Women's, Children's and Adolescents' Health (2016-2030): The "Every Woman Every Child (EWEC) Global Strategy" indicator and monitoring framework includes 60 indicators: 34 from the Sustainable Development Goals (SDG) and 26 from related global monitoring initiatives. From these, 16 key indicators are highlighted to provide a snapshot of progress. With indicators across health and other sectors, this framework represents a new multi-partner, multi-sector approach to health and SDG monitoring.

To provide public access to the latest available data and estimates across all countries and for all the Global Strategy indicators, the World Health Organization has built a dedicated Global Strategy portal linked to the Global Health Observatory (GHO). Development of the portal, and updating of the associated data, has involved collaboration across WHO departments, United Nations organizations – including the UN Statistics Division, UNICEF and other H6 agencies and UNESCO – and global monitoring partnerships, including academic institutions.

Global Health Security Agenda: The Global Health Security Agenda (GHSA) was launched in February 2014 and is a growing partnership of over 50 nations, international organizations, and non-governmental stakeholders, which help build countries' capacity to help create a world safe and secure from infectious disease threats and elevate global health security as a national and global priority. GHSA pursues a multilateral and multi-sectoral approach to strengthen both the global capacity and nations' capacity to prevent, detect, and respond to human and animal infectious diseases threats whether naturally occurring or accidentally or deliberately spread.

Africa CDC: The African Union (AU) Heads of State and Government (AU HoSG) at the Special Summit on HIV and AIDS, TB and Malaria in Abuja (July 2013), recognized the urgent need to put in place a Specialised Agency to support African Union Member States in their efforts to strengthen health systems through capacity building, which would result in effectively responding to emergencies, addressing complex health challenges and conduct life-saving research in the Public Health Sector. In this Special Summit, the Assembly requested the African Union Commission to work out the modalities of establishing the Africa Centres for Disease Control and Prevention (Africa CDC). Subsequently, the Africa CDC was established, and its statute approved by the 26th Assembly of the Heads of State and Government in January 2016 and officially launched on 31st January 2017 in Addis Ababa, Ethiopia. The Africa CDC supports all African countries to improve surveillance, emergency response, and prevention of infectious diseases. This includes addressing outbreaks, man-made and natural disasters, and public health events of regional and international concern. It further seeks to build the capacity to reduce disease burden on the continent. According to its five-year strategic plan, the Africa CDC will, within the next two years, support the establishment of centralised event-based surveillance for priority pathogens in Africa and of 5 Regional Collaborating Centres that will strengthen existing surveillance and laboratory networks. Africa CDC will also establish a rapid response team to address health threats, supplemented with a continent-wide Africa Health Volunteers Corps. The Africa CDC will define protocols for outbreak declaration and response while advocating for the establishment of Emergency Operational Centres in each country. The Africa CDC will define a system to organise national surveillance data and work towards uniform health information standards for Africa. It will concurrently work on creating policy frameworks to guide countries to strengthen their public health institutes.

One of the initiatives established under the Africa CDC is the ECOWAS Regional Centre for Disease Control project, which aims to establish an ECOWAS Regional Centre for Disease Control in Abuja, Nigeria. The project has goals to 1) strengthen regional capacities of threats and others health emergencies surveillance; 2) strengthen regional reference laboratories capacities; 3) establish a functional regional of Rapid Intervention Team (ECOWAS White Helmets) in the event of epidemic and others health emergencies; and 4) strengthen institutional capacities of NCI on the surveillance of threats and others health emergencies and resilience to shocks.

Preparedness and Response Program: The Preparedness and Response Program works in 16 countries across Africa and Southeast Asia, which includes 5 ECOWAS countries (Cote D'Ivoire, Guinea, Liberia, Mali and Sierra Leone), to strengthen national systems, policies and practices for the prevention, detection and response to public health threats. As part of the U.S. Agency for International Development's Emerging Pandemic Threats 2 Program, the Preparedness and Response Program strengthens the use of One Health approaches in strategic planning; develops policies for human and animal health; encourages sharing of accurate health information to help guide management of activities; assists governments to assess their preparedness and response capacity; designs and implements consensus-based capacity building; and supports institutional and organizational development and cooperation at regional, national, and subnational level.

Regional Disease Surveillance Systems Enhancement Project: The Regional Disease Surveillance Systems Enhancement (REDISSE) Project is a World Bank funded project being implemented in the ECOWAS region. The development objectives of the REDISSE project are **1)** to strengthen national and regional cross-sectoral capacity for collaborative disease surveillance and epidemic preparedness in West Africa; and **2)** in the event of an eligible crisis or emergency, to provide immediate and effective response to said eligible crisis or emergency.

West African Health Information Team: Health Policy Plus is supporting WAHO to develop and train the West Africa Health Informatics Team (WAHIT). WAHIT is a team of local health informatics experts that will provide technical leadership and support to ministries of health across ECOWAS to strengthen health information systems through local capacity building.

Specifically, WAHIT is:

- Making immediate technical improvements in national and regional digital health information systems
- Building local software developer capacity to support the long-term sustainability of health information system investments
- Helping establish a regional Health Information System Centre of Excellence

Together, these efforts aim to fortify the existing health information systems throughout West Africa and build local capacity to better monitor, detect, and prevent future disease outbreaks.

Sahel Malaria and Neglected Tropical Diseases: The Sahel Malaria and Neglected Tropical Diseases Project is funded by the World Bank. The objective of the Sahel Malaria and Neglected Tropical Diseases Project is to increase access to and use of harmonized community-level services for the prevention and treatment of malaria and selected neglected tropical diseases in targeted cross-border areas in participating countries in the Sahel region. There are three components to the project, the first component being improve regional collaboration for stronger results across participating countries. This component supports countries' efforts to harmonize policies and procedures and engage in joint planning, implementation, knowledge exchange and evaluation of malaria and NTD service delivery. This component includes three sub-components, which include 1) the establishment of a regional coordinating committee comprised of national program managers and supported by a technical advisory group (TAG); 2) regional research; and 3) regional pooled drug procurement. The second component involves supporting the coordinated implementation of technical strategies and interventions. This component will support countries' efforts to jointly control malaria and NTDs through community-based interventions in cross-border areas. Finally, the third component is to strengthen institutional capacity to coordinate and monitor implementation. This component provides support to country level implementing agencies and regional institutions to perform core functions and ensure that the project is well implemented, monitored and evaluated.

Regional Programme Support to Pandemic Prevention in the ECOWAS Region: The Regional Programme Support to Pandemic Prevention in the ECOWAS Region (RPPP) was funded (€7 million) by GIZ in 2017. The objective of RPPP is to ensure that the population in the ECOWAS region is better protected against epidemics. GIZ will be providing technical assistance including ICT to WAHO to ensure that the advice provided by the ECOWAS Commission with its institutions and specialist agencies. The key focus for GIZ is on the 3 post-Ebola countries, and for Nigeria, Niger, Burkina Faso, Cote D'Ivoire and Togo for KfW.

The RPPP project has three key outputs:

- Improve gender-sensitive health risk communication in the ECOWAS region;
- Strengthen inter-institutional communication and coordination between the ECOWAS Commission and its agencies on health issues;
- Strengthening human resources to assist the ECOWAS member states to better perform their tasks in disease control.

The Epidemiological Surveillance Network of West African National Public Health Institutes: The Epidemiological Surveillance Network of West African National Public Health Institutes (RIPOST) was launched in April 2017 and will be implemented by a consortium of French actors led by AMP and co-funded by AFD and MAEDI. RIPOST aims at supporting WAHO to reduce morbidity and mortality from potential epidemic diseases, by strengthening surveillance capacities of community actors in the 6 beneficiary countries: Benin, Burkina Faso, Côte d'Ivoire, Guinea, Niger and Togo.

- **Capacity building:** development activities for public health professionals in field epidemiology (monitoring, information systems, epidemiology investigations and response)
- **Community mobilization:** development activities to strengthen social and community mobilization for the prevention of and fight against epidemics

Emergency Management Program: eHealth Africa's Emergency Management Program works on Ebola outbreak response efforts in Nigeria, Sierra Leone, Liberia, and Guinea. It provides logistics and data management support, which has significantly reduced the response time to procure test results and streamlined the processes of tracing and monitoring potentially infectious individuals. In Nigeria, the eHealth Africa Emergency Management Program led the development of Ebola Emergency Operations Centres (EEOC), and an electronic contact tracing system which contained the outbreak, limiting transmission to only 20 cases. The rapid mobilization in Nigeria and eHealth Africa's effective use of technology received international praise.

eHealth Africa's Emergency Management Program focuses on:

1. **Data Management Tools:** Sense provides field contact tracers with real-time reporting and GPS tracking capabilities, and eHealth Africa have developed an application that provides information on all current contacts and EVD cases. Field trackers report symptoms of contacts and capture their GPS whereabouts within a Case Management dashboard;
2. **Call Centre Management and Applications:** eHealth Africa operates call centres in Guinea and Sierra Leone and provides the Liberian emergency call line with custom Ebola call centre software. Call lines notify district offices of potential new cases and hotspots and provide callers with accurate protection information;
3. **Emergency Operation Centre Management and Construction:** The EEOC provides designated workspace to coordinate and plan activities, and technological resources to develop initiatives. eHealth Africa aids government partners to build centres, long-term centre management, and technical support;
4. **Logistics and Technical Support:** eHealth Africa offers workspaces, technical support, internet, and power backup to all partners. eHealth Africa can rapidly procure, and provide management, and distribution services for critical equipment including vehicles and laptops;
5. **Data collection tools:** eHealth Africa develops data collection tools, communications technologies to connect facilities and health workers, and health information systems that have improved information flows between partners.

WAHO-CAPS Project: The WAHO-CAPS project is funded by USAID, and its purpose is to strengthen WAHO's leadership capacity to reinforce an enabling environment in the West African region, which will allow for increased uptake and usage of health services.

The intended outcomes of the WAHO-CAPS project include:

1. increasing support to ECOWAS member states to scale up evidence-based practices;
2. operationalizing advocacy and communication strategies;
3. expanding member states role in regional donor, public and private partnerships; and
4. operationalizing policy and strategy around regional health information systems.

Maternal Death Surveillance and Response Initiative: The Maternal Death Surveillance and Response (MDSR) initiative is a continuous-action cycle designed to provide real-time, actionable data on maternal mortality levels, causes of death, and contributing factors, with a focus on using the findings to plan appropriate and effective preventive actions. The MDSR system aims to identify, notify, and review all maternal deaths in communities and facilities, thus providing information to develop effective, data-driven interventions that will reduce maternal mortality and permit the measurement of their impact.

Campaign on Accelerated Reduction of Maternal, New-born & Child Mortality in Africa: In May 2009, the African Union launched the Campaign on Accelerated Reduction of Maternal Mortality in Africa (CARMMA) to trigger concerted and increased action towards improving maternal and new-born health and survival across the continent. As such, CARMMA is not a new initiative; rather, it is derived from the key priority areas enshrined in the AU Policy Framework for the promotion of Sexual and Reproductive Health and Rights in Africa (2005) and the Sexual Reproductive Health Strategy.

The main objective of CARMMA is to expand the availability and use of universally accessible quality health services, including those related to sexual and reproductive health that are critical for the reduction of maternal mortality. The focus is not to develop new strategies and plans, but to ensure coordination and effective implementation of existing ones. CARMMA aims to renew and strengthen efforts to save the lives of women who should not have to die while giving life. CARMMA believes in ensuring accountability: every single loss of a mother's or child's life should be reported.

Activities of the campaign include mobilizing the necessary political will to make the lives of women count, coordinating and harmonizing interventions around country-led plans/roadmaps and supporting ongoing efforts and initiatives to improve maternal, new-born and child health.

Countdown 2030 Initiative: Countdown to 2030 tracks coverage levels for health interventions proven to reduce maternal, new-born and child mortality. It calls on governments and development partners to be accountable, identifies knowledge gaps, and proposes new actions to reach Millennium Development Goals 4 and 5, to reduce child mortality and improve maternal health. Over the course of 12 years, Countdown has gathered and synthesised data on intervention coverage and its key determinants, and regularly disseminated country profiles, synthesis reports, scientific articles, and in-depth country analyses (Afghanistan, Bangladesh, China, Ethiopia, Kenya, Malawi, Niger, Pakistan, Peru, and Tanzania).

Sahel Women's Empowerment and Demographic Dividend Project: The SAHEL Women's Empowerment and Demographic Dividend (SWEDD) project aims to support family planning in the SAHEL region by 1) generating demand for RMNCH commodities and services, through the promotion of social and behavioural change, as well as empowering women and adolescents; 2) strengthening regional capacity to improve supply of RMNCH commodities and qualified personnel; and 3) strengthening project high level advocacy and policy dialogue, as well as capacity for policy making and project implementation.

Project Démographie et santé sexuelle et de la Reproduction: Project Démographie et santé sexuelle et de la Reproduction (DEMSAN) was funded (€10 million) by l'Agence Française de Développement (AFD) in late 2016, to run from 2017 – 2020, under the technical supervision of WAHO, with strong involvement of ministries of health and NGOs from ECOWAS countries, particularly Mali.

The aims of DEMSAN are;

- Strengthen the role and missions of the WAHO in the steering and knowledge management of demographic and sexual and reproductive health (SRH) issues;
- Strengthen political advocacy for SRH issues and rights and promote the emergence of civil society in these areas;
- Strengthen the capacity of ECOWAS Member States to develop and implement policies and strategies for sexual and reproductive health and rights.

Systems for Improved Access to Pharmaceuticals and Services Program: USAID's Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program was designed to strengthen the management of essential medicines and health supplies so that more people can access the health care they need. The SIAPS program is of particular importance to the RAD project due to its involvement in and knowledge of logistic management information systems (LMIS). The SIAPS program, however, takes a comprehensive approach to improving pharmaceutical systems, and therefore not only enhances countries' capacity to procure and distribute high-quality medicines and health technologies, but also works with local partners to develop strong systems for health financing, human resources, governance, information, service delivery, and pharmacovigilance.

The SIAPS program has operations in Ethiopia, Kenya and Uganda in the IGAD region, as well as Nigeria and Mali in the WAHO region. Other country operations include Tanzania, Rwanda, Namibia, Zambia, Malawi, Mozambique, Zimbabwe and Botswana.

East Africa Public Health Laboratory Networking project: The East Africa Public Health Laboratory Networking (EAPHLM) project is funded by the World Bank for \$64mn from 2010 to 2020. The EAPHLM project for Africa aims to establish a network of efficient, high quality, accessible public health laboratories for the diagnosis and surveillance of tuberculosis and other communicable diseases.

The additional financing for Burundi, Kenya, Tanzania, and Uganda will assist to:

- scale up successful activities to additional facilities in cross border areas, further expanding geographic coverage; and
- broaden and deepen the range of interventions to be funded (that is, establishing isolation units; strengthening community surveillance activities; and supporting joint training in line with the one health approach to enhance effectiveness and impact of health systems in terms of management and containment of communicable diseases.

The additional funding activities will be implemented through established national structures and coordinated regional platforms that have been used over the past five years.

African Medicines Registration Harmonization (AMRH) Initiative: The initiative works with Regional Economic Communities to increase access to good quality, safe and effective medicines through harmonizing medicines regulations, and expediting registration of essential medicines. It is supported by a consortium including the New Partnership for Africa's Development (NEPAD), the Pan African Parliament (PAP), BMGF, DFID, CHAI, UNAIDS, and the WHO. As part of this larger initiative, IGAD received funding for the IGAD-Medicines Regulatory Harmonization Initiative (MRH) and has organized conferences, including regional meetings with national medicines regulatory authorities of the region which have resulted in two declarations (Khartoum 2016 and Addis Ababa 2017). The initiative has a regional information management component, although the details still need to be made available.

Cancer Centre of Excellence: Since 2014, IGAD are preparing the establishment of a Regional Centre of Excellence for Cancer Diagnosis and Treatment in Addis Ababa. The initiative has received in-kind support from the Ethiopian Government (land) and aims to launch an initial situational assessment across the IGAD member states to understand the epidemiological situation and most important gaps.

Drought Disaster Resilience Sustainability Initiative (IDDRSI): This is a data-driven initiative which seeks to strengthen drought disaster resilience. The 15-year initiative still has nearly 10 years of funding and seeks (among other things) to improve disaster preparedness and preventive action using research, knowledge, technology and innovations. While primarily related to the division of agriculture and environment, IDDRSI cuts across the IGAD divisions and addresses issues related to social development, health, peace and security. As part of the initiative, several information portals were initiated, which make available data from various sources, including health projects.

IGAD Global Fund Refugee Project: The main health-related project implemented by IGAD (apart from RAD), which also started in 2017, is a Global Fund (GF)-supported project on refugee health that focuses on TB and HIV in 20 camps. The grant runs for 30 months (2.5 years). The initial project proposal sought to include more sites, as well as cover malaria, but was re-focused due to budget constraints. Sub-recipients of the grant are the Kenyan Red Cross and the Ethiopian Administration for Refugee Affairs (ARA). The Global Fund project is expected to replicate several of the structures and processes of the IRRAP project, some of which are described below.

BlueSquare: BlueSquare creates value from data and helps people make better decisions. BlueSquare is an organization that has experience in building data visualization for results-based financing for World Bank projects. BlueSquare has since evolved to offer add-on software to DHIS2, including a public-facing data visualization interface, a feedback loop to health workers, and a user-interface to build custom algorithms for data analysis.

BlueSquare's technologies promote smarter allocation of resources in emerging economies. BlueSquare's systems and tools boost the reach, quality and efficiency of public services around the world and give users access to key performance data. They allow users to easily collect, manage, structure, visualize and share data. They also create a link between financing and results, by transforming traditional aid into data-driven systems – encouraging better stewardship, accountability and transparency of programs.

African Population and Health Research Centre: The African Population and Health Research Centre (APHRC) is committed to generating an Africa-led and Africa-owned body of evidence to inform decision making for an effective and sustainable response to the most critical challenges facing the continent. As a Pan-African, reputable academic research institution, APHRC had a leading role in efforts related to the 'African Data Revolution' (Statistics for Development). They also have a leading role in the IDRSC-funded "Moving Maternal New-born and Child Health Evidence into Policy" initiative and in the activities of Countdown 2030, both of which are relevant to RAD. The institution is well networked with academic institutions and with funders of knowledge translation initiatives globally and has a broad health systems expertise.

International Development Research Centre: Through their Innovating for Maternal and Child Health in Africa (IMCHA) programme, The International Development Research Centre (IDRC) support implementation research and knowledge-to-practice for MCH in both West and East Africa, in collaboration with WAHO, APHRC and other organisations. IDRC also support statistics for development and development research in Africa beyond IMCHA.

Health Data Collaborative: The Health Data Collaborative (HDC) is an inclusive partnership of international agencies, governments, philanthropies, donors and academics, with the common aim of improving health data. Countries are at the core of what the HDC does, and therefore works alongside these countries to improve the availability, quality and use of data for local decision-making and tracking progress toward the health-related Sustainable Development Goals (SDGs). The HDC is establishing a network of working groups that will address specific technical issues and identify and fill technical gaps. The working groups develop standards, indicators and other tools that help countries to collect, analyse and use good health data.

4.1.4. Data Sources

Sub-purpose 1 involves developing a regional data and analytics solution, which will aggregate and analyse disparate sources of data, to empower stakeholders with information for evidence-based action. It was therefore pertinent to investigate existing data sources that could be aggregated and analysed for information generation and dissemination.

National Health Information Systems

A central characteristic of the RAD project, and the purpose of the landscape analysis, is to understand the context in which the RAD project will be implementing solutions, to learn from and complement existing initiatives. It was therefore pertinent to investigate and understand existing national health information systems within the relevant member states.

Table 7: National Health Information Systems in Member States

Country	DHIS2 ⁶	LMIS	LIS	HRIS	OpenMRS
Uganda	✓	✓		✓	✓
Kenya	✓	✓		✓	✓
Ethiopia	✓	✓		✓	✓
Sudan	✓	✓		✓	
South Sudan	✓ ⁷	✓		✓	
Djibouti		✓		✓	
Somalia	✓	✓		✓	
Cote d'Ivoire	✓	✓	✓		✓
Togo	✓			✓	
Ghana	✓		✓	✓	✓
Benin	✓				
Burkina Faso	✓				
Cabo Verde					
Liberia	✓			✓	✓
Mali	✓			✓	
Sierra Leone	✓			✓	✓
Senegal	✓			✓	
Niger	✓				
Nigeria	✓			✓	✓
Gambia	✓				✓
Guinea	✓			✓	
Guinea-Bissau	✓				

⁶ Progress with DHIS2 varies between countries; some countries have not yet rolled it out nationally but are planning to do so based on their experience with pilot implementations.

⁷ Currently using DHIS1 (desktop based)

DHIS2: DHIS2 is a flexible, web-based open-source information system with visualization features including GIS, charts and pivot tables. DHIS2 is currently implemented in 47 countries, of which 29 are in Africa. According to the DHIS2 website, countries with complete national implementation include Burkina Faso, Ghana, Kenya, Liberia, Mozambique, Nigeria, Rwanda, Sierra Leone, Tanzania, Gambia, Uganda, Zambia, Zanzibar and Zimbabwe. Countries with partial national roll-out or Adoption by programs include Algeria, Burundi, Democratic Republic of Congo, Malawi and South Africa. Countries in pilot stage or early phase roll-out include Benin, Côte D'Ivoire, Guinea Bissau, Namibia, Niger, Senegal, South Sudan, Sudan and Togo. WAHO uses DHIS2 to consolidate aggregate health data from the 15 ECOWAS member states: Benin, Burkina Faso, Cape Verde, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo.

iHRIS: iHRIS is IntraHealth International's free, open source software, which helps countries around the world track and manage their health workforce data to improve access to services. Countries use it to capture and maintain high-quality information for health workforce planning, management, regulation, and training. iHRIS is built on a flexible framework that allows ministries of health, professional councils, and health service delivery organizations to adapt applications for a wide variety of uses. Developed in collaboration with national stakeholders beginning in 2005, with support from USAID, iHRIS is used in more than 20 countries to manage over a million health worker records. In Africa these include South Sudan, Uganda, Kenya, Mali, Senegal, Guinea, Liberia, Sierra Leone, Ghana, Togo, Nigeria and Chad, as well as Tanzania, Rwanda, Burundi, Democratic Republic of the Congo, Malawi, Namibia, Botswana and Lesotho.

OpenMRS: OpenMRS is a multi-institution, non-profit collaborative led by Regenstrief Institute, a world-renowned leader in medical informatics research, and Partners in Health, a Boston-based philanthropic organization with a focus on improving the lives of underprivileged people worldwide through health care service and advocacy. OpenMRS is a software platform and a reference application which enables design of a customized medical records system. It is a common platform upon which medical informatics efforts in developing countries can be built. The system is based on a conceptual database structure, which is not dependent on the actual types of medical information required to be collected, or on data collection forms, and so can be customized for different uses. At its core is a concept dictionary which stores all diagnosis, tests, procedures, drugs and other general questions and potential answers. OpenMRS is a client-server application, which means it is designed to work in an environment where many client computers access the same information on a server. In the WAHO region, OpenMRS is currently being used in Liberia, Cote d'Ivoire, Nigeria, Ghana, Sierra Leone and The Gambia, while in the IGAD region, OpenMRS is currently being used in Uganda, Kenya and Ethiopia. Other countries in which OpenMRS is being used include Cameroon, Chad, Lesotho, Zimbabwe, Mozambique, Malawi, Democratic Republic of The Congo, Burundi, Rwanda and Tanzania.

Site Assessment Findings

In Ghana, the entire health system data collection vertical hinges on DHIS2 for service data collection from facilities and IDSR data. Cote d'Ivoire and Togo on the other hand report various difficulties with respect to obtaining data from private, for-profit facilities in particular, with the main problem being the unavailability of digital tablets as reported in Togo. For example:

"Since 2017, private facilities (especially faith-based) submit data, which is unproblematic in rural areas. Getting data from the private (for-profit) sector in Lomé is difficult. However, MoH/ world Bank intend to distribute tablets for DHIS2 data entry to all private facilities as well and expect them to submit data."

In Cote d'Ivoire, Togo and Ghana there is a multitude of software systems used for programmatic areas (such as MNCH, IDSR, TB), and these include DHIS2, eDVDMT, EPI-Info, RapidPro, and Magpi. The table on page 31 shows the software systems used in each of the thematic areas.

Ghana has successfully implemented DHIS2 for collection of case-based data for immunisation, IDSR and MNCH. However, Togo and CI use multiple systems in parallel for capturing data from various programmes even though it could also be collected with DHIS2.

In Ghana, health service data is entered into DHIS2 at the facility level as most of the facilities have been given login credentials to the national DHIS2 platform. Each facility is required to show evidence of submitting data monthly to the DHIS2 prior to their application for the renewal of their practice license. This process, managed by the Health Facility Regulatory Authority under the Ministry of Health, provides a tangible incentive for private facilities to ensure that they are submitting data.

Public facilities, by the very fact that they are government owned submit data monthly for all programmes. Service data is generally updated monthly in each of the 3 ALCO countries visited. Below is an excerpt from a respondent:

“IDSR data is captured weekly and monthly. HR data is updated quarterly, but Data from the eTracker is updated every day. Routine health service data is updated monthly, and roughly 95% of facilities nationwide do this. There are also about 4 quarterly reports. Inpatient beds, cause of death, status of delivery these are note monthly.”

Togo and Cote d'Ivoire have no formal incentive schemes for ensuring data is collected and submitted. The only mechanism at work to compel data collection is the mild embarrassment suffered when one is reported higher up the management chain for non-submission of data, with the accompanying perception of incompetence.

As can be expected not all facilities (in Ghana) are able to submit data themselves so the national HMIS standard operating procedures document provides a way out for such facilities, permitting them to submit paper-based registers to the district health directorate, who enter the data into DHIS2 on behalf of the facility. A notable group of facilities that aren't submitting data to the national DHIS2 in Ghana is the group of teaching hospitals. Under Ghana's legislation, the teaching hospitals are themselves an agency under the Health Ministry and as such are not obliged to follow the mandates of the Ghana Health Service, also an agency that is the implementing arm of the Ministry of Health.

The Ghana Health Service however acknowledges that this is a problem and that a large section of data is excluded because the teaching hospitals do not submit data. To remedy this, a meeting was held in October 2017 where 2 teaching hospitals have agreed to submit data to the national DHIS2 instance although it is unclear if they have begun data submission.

Facility level data collection in Togo is likely to begin in March 2018 given that the World Bank has supported their efforts with the provision of digital tablets. On the other hand, data collection in Cote d'Ivoire is done at the district level.

All three countries agree on the importance of data quality and all report timeliness and completeness as one of their main metrics. The district level completion of data in Cote D'Ivoire can be said to be OK, but completeness at the facility level can be improved.

Patient-level identification mechanisms aren't standardised at the national level in each of the countries visited. Ghana's GHS has its own system based on its Medical Records Policy, but Cote d'Ivoire and Togo are waiting for the roll out of their National Identification Systems.

Table 8: Health Information Systems in Cote d'Ivoire, Ghana and Togo by theme

Theme	Cote D'Ivoire	Ghana	Togo
Health Service Statistics	Sig Santé (DHIS2)	DHIS2	DHIS2 (to be launched in 2018)
Disease Surveillance and Response	MagPie and DHIS2 ¹	DHIS2	EpilInfo + ARGUS
Immunization	eDVDMT	eTracker (DHIS2)	eDVDMT
Logistics	eLMIS (eSICLE)	eTracker (DHIS2)	SAGE + DVDMT/SMT
Maternal Mortality	MagPie. Forms are also available in DHIS2	DHIS2	EpilInfo
Laboratory Information System	OpensELIS (currently in early stages of deployment)	BLIS	No system

Data integration from multiple health-related sources appears to be a national priority. Compared to the West African Health information systems, the Ugandan HMIS ecosystem is more tightly integrated with other areas such as supply chain management and pharmacies. The health supply chain system is linked to the information system used by large private sector pharmacies. Furthermore, registrations of pharmacies are centralised, and the list made public, so any client can enter a pharmacy's registration number and check if they're registered or not.

The ministry of health in Uganda is mandated to supply data to the EAC, and this has been successfully achieved with an automated, periodic data transfer from their local, on-premise data warehouse. Data submission by private sector is an obligation, and they contribute a minimum, pre-agreed data set monthly.

Table 9: Frequency of data cleaning and validation

Country	Frequency of data cleaning and validation	Mechanism
Ghana	Monthly	District and national data review committees.
Uganda	Yearly	Data review and filed visits.
Cote d'Ivoire	Quarterly	This happens via data review committees but doesn't always happen because of lack of resources such as pickups to go to the facilities to check the registers.
Togo	Monthly / ad hoc	Professionals at the national, regional, and district level meet every month to review HIS quality. There is also supervision from the national to the regional, and the regional to the district levels, whereas the district raises issues around data quality directly with the facilities.

In Uganda, stakeholder interviews unearthed concerns about data quality (late reporting, incomplete reports and limited access to health records due to poor record keeping and use of paper-based records at health facilities) resulting in the apparent lack of trust in national data by partners. This is due to logistical and human constraints. Health facilities have challenges in identifying returning patients, and the tracking between facilities and mobile cross-border population is difficult. This is worse in hard-to-reach border areas due to limited mobile network strength and internet connectivity and limited supportive supervision by officers from the respective district health offices. This has led to the development and operation of multiple of parallel systems. Plans to harmonise are underway, but the issues of trust in the data needs to be firstly addressed.

Other Data Sources Relevant to Sub-Purpose 1.

Table 10: Other data sources relevant to sub-purpose 1.

Data Source	Region	Thematic Area	Frequency
Electronic Civil Registration and Vital Statistics Systems	East & West Africa	MNCH	Routine
SORMAS	West Africa	Disease Surveillance	Routine
CommCare	East & West Africa	Malaria	Routine
FioNet	East & West Africa	Malaria	Routine
GxAlert	East & West Africa	TB	Routine
mHero	West Africa	Disease Surveillance	Routine
MOTEC	East and West Africa	MNCH	Routine
Health Resources Availability Monitoring System (HeRAMS)	West Africa	Health Resources	Routine
Demographic and Health Surveys	East & West Africa	MNCH, FP, TB & Malaria	Periodic
Demographic and Health Survey Geographic Data	East & West Africa	GIS	Periodic
Malaria Indicator Surveys	East & West Africa	Malaria	Periodic
Multiple Indicator Cluster Surveys	East & West Africa	MNCH, FP & Malaria	Periodic
Service Availability and Readiness Assessment Survey	East & West Africa	MNCH, FP, TB & Malaria	Periodic
WHO Global Health Observatory	Sub-Saharan Africa	MNCH, FP, TB & Malaria	Periodic
Data Source	Region	Thematic Area	Frequency
United Nations Data Catalogue	Sub-Saharan Africa	MNCH, FP, TB & Malaria	Periodic
Humanitarian Data Exchange	Sub-Saharan Africa	MNCH, FP, TB & Malaria	Periodic
Malaria Atlas Project	Sub-Saharan Africa	Malaria	Periodic
Mapping Malaria Risk in Africa	Sub-Saharan Africa	Malaria	Periodic
AfriStat	West Africa	MNCH, FP, TB, Malaria	Periodic
WorldPop	Sub-Saharan Africa	Demographic	Periodic
OpenWeatherMap	Sub-Saharan Africa	Climate	Routine

Routine Data Sources

Electronic Civil Registration and Vital Statistics Systems: Cabo Verde has a birth registration coverage that is 90% or higher. Burkina Faso, Mali, Senegal, Sierra Leone and Togo have birth registration coverage rates of 75–89%. Though it is not ideal, it is sufficient for some statistical purposes. Less than 20% of births are registered in Ethiopia and Liberia. Regarding mortality data, of the 46 countries in the WHO Afro region, only four (Algeria, Mauritius, Seychelles and South Africa) have coverage rates of 75% or higher. Civil registration and vital statistics are therefore considered the weakest data sources in almost all low and middle-income countries. The absence of functioning civil registration and vital statistics systems affect the ability to monitor progress of virtually all programmes. Because of the limited development of vital registration systems, most developing countries depend on surveys and censuses to estimate population morbidity and mortality.

Most countries still primarily rely on paper for a bulk of their recording and reporting of births and deaths. In strengthening these systems, there have been initiatives to scan the paper records, because much historical

data only appears in paper, and because paper has been found to be a reliable technology in the lack of other solutions. However, in Kenya, two electronic systems, both based on mobile phones, were developed under the MOVE IT project to register births and deaths. The first is Rapid SMS, and the second, an application developed by a private company called Multiple Choice Labs, which allows using 2G mobile phones for notifying deaths using OpenXdata. In Uganda, where 43% of births occur outside health facilities, a mobile solution is being piloted for enhancing notification of births. In this intervention, community health workers are given access to the central database using mobile phones to update birth information.

SORMAS: SORMAS is an early warning and management system based on flexible mobile telephone applications. SORMAS uses cloud technologies to enable infection chains and ensure continuous analysis of the disease situation. Disease included in the SORMAS system are the Ebola Virus Disease, Lassa fever, Cholera, Meningitis, Avian Influenza, Viral Haemorrhagic Fevers and Measles. WAHO has endorsed SORMAS as an efficient tool for use in West Africa for surveillance and Outbreak Management. It is in the early stages of implementation in Nigeria and Ghana.

CommCare: CommCare is a widely adopted, technically advanced, and evidence-based mobile platform for low-resource settings. In West Africa, CommCare has been used in Benin, Burkina Faso, Chad, Guinea, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo. In East Africa, CommCare has been used in Uganda by inScale, which uses images and audio to train CHWs on consultation steps to assess, classify, treat and refer patients. In Mozambique APE (Agente Polivalentes Elementares) are Community Health Workers (CHW) is an example of CHWs. The decision support tool includes a checklist of mild and severe signs of diarrhoea, pneumonia and malaria and provides treatment guidance. The application also collects weekly case data and drug stock levels that are sent to a central server. The two main features include the APE CommCare support tool and the CommCare HQ web-based, real-time dashboard for program planners. Using images and audio, the inScale APE CommCare application walks APEs through the consultation steps to assess, classify, treat and refer patients. The decision support tool includes a checklist of mild and severe signs and provides treatment guidance. In addition, APEs can use a built-in and simplified respiratory timer to detect pneumonia symptoms. Individual patient data is stored on the phone and, once a network connection has been established, is sent to a server, along with weekly aggregated case data and drug stock levels.

FioNet: FioNet: In West Africa, FioNet is being used in Sierra Leone, Ghana and Liberia, while in East Africa, FioNet is being used in Kenya and Tanzania. Health workers and managers use the FioNet suite of solutions for the purposes of Ebola and malaria RDT, reporting and case management. FioNet connects mobile companion devices that guide diagnosis, treatment and record keeping with web-based tools for remote oversight and reporting. FioNet mobile software is designed for use with standard Android devices and the Deki Reader. The Deki Reader is an in vitro diagnostic device for use with commercially available lateral flow immunoassays (commonly known as rapid diagnostic tests). The Deki Reader provides step-by-step guidance for performing rapid diagnostic tests and delivers an objective analysis of results. Meanwhile, FioNet provides test-by-test traceability. Mobile companion devices provide in-process quality control checks and configurable workflows for standardizing care delivery and data capture. Web-based tools provide timely, accurate and complete records from individual patient visits; reports generated from aggregated, primary data; two-way messaging with companion devices; and data transfer and IT integration.

GxAlert: The GeneXpert device (and others like Hain Lifescience MTBDRplus) are designed to integrate into Laboratory Information Systems (LIS) so they can receive orders for Tuberculosis diagnoses and automatically send results. GxAlert acts as a proxy for any specific LIS. Results are automatically sent from a GeneXpert over an Internet connection to the GxAlert application. GxAlert then provides robust and clear documentation to connect existing M&E systems (like eTB Manager). In the IGAD region, GxAlert is implemented in Kenya and Uganda, while in the WAHO region, GxAlert is implemented in Nigeria, Cameroon and Burkina Faso. Other countries of implementation include Rwanda, Democratic Republic of The Congo, Mozambique and Botswana.

mHero: mHero is a two-way, mobile phone-based communication system that uses basic text messaging, or SMS, to connect ministries of health and health workers. mHero operates on simple talk-and-text mobile devices, with no smartphone or tablet required. IntraHealth International and UNICEF created mHero in August 2014 to support health-sector communication during the Ebola outbreak in Liberia. mHero is currently being used in West Africa in Guinea, Mali, Liberia and Sierra Leone.

MOTECH: MOTECH is an open source enterprise software system from Grameen Foundation that harnesses the ubiquity of mobile phones to deliver and receive information from patients and caregivers. The MOTECH system helps community health workers to record and track the care delivered to women and new-borns in their area. Each rural health facility is equipped with low-end mobile phones on which the MOTECH Java application for health workers is installed. Nurses enter data about patients' clinic visits into forms on the mobile phone and send this to the MOTECH servers. The MOTECH system then checks patients' healthcare information against the schedule of treatment. If the system sees that a patient has missed care that is part of the advised schedule, the system sends a message to remind the patient to go to the clinic for that service. Meanwhile, the healthcare worker is informed when the patient becomes overdue for treatment so that they can follow up with them and reduce the number of clients defaulting for recommended healthcare. Using the data nurses have submitted to the server, MOTECH also generates many of the monthly reports that facilities are required to submit to their district and regional management offices. The MOTECH system is being used in Sierra Leone, Ghana, and Nigeria in West Africa, as well as Uganda in East Africa. Other countries where MOTECH is used include Mozambique and Zambia.

Health Resources Availability Monitoring System: The Health Resources Availability Monitoring System (HeRAMS) approach was developed to face the challenges of monitoring the availability of health services during an emergency, in terms of uncertainties around access, security and time limitations, which frequently prevent systematic information gathering. This lack of information, in return, hampers effective decision-making, resource allocation, mobilization and advocacy for health in emergencies. HeRAMS is an approach for monitoring health facilities, services and resources availability in emergencies. HeRAMS can be applied in a range of emergencies, post-emergencies, recovery and development contexts. The HeRAMS App provides a monitoring feature that allows tracking the evolution of the situation over time and helps re-adjust objectives and priorities as the situation evolves. HeRAMS is currently being implemented in West Africa in Mali and Nigeria, as well as the Central African Republic in Central Africa.

Surveys

Demographic and Health Surveys: Demographic and Health Surveys (DHS) are nationally-representative household surveys that provide data for a wide range of monitoring and impact evaluation indicators in the areas of population, health, and nutrition. There are two main types of DHS surveys; Standard DHS surveys and interim DHS surveys. Standard DHS surveys have large sample sizes (usually between 5,000 and 30,000 households) and typically are conducted about every 5 years, to allow comparisons over time. Interim DHS surveys focus on the collection of information on key performance monitoring indicators but may not include data for all impact evaluation measures (such as mortality rates). These surveys are conducted between rounds of standard DHS surveys and have shorter questionnaires than standard DHS surveys. Although nationally representative, these interim surveys generally have smaller samples than standard DHS surveys.

Demographic and Health Survey Geographic Data: Geographic data from over 100 DHS surveys in over 45 countries are available online for download upon request. The data include latitude and longitude coordinates of the surveyed communities and/or health facilities and can be linked to the DHS dataset.

Malaria Indicator Surveys: The Malaria Indicator Survey (MIS) is a stand-alone household survey, which collects national and regional or provincial data from a representative sample of respondents. MIS collects data on all of the internationally recognized malaria indicators including, household ownership of insecticide-treated mosquito nets and their use, especially by children under five years of age and pregnant women; Intermittent preventive treatment against malaria during pregnancy; the type and timing of treatment of high fever in children under five years of age; indoor residual spraying of insecticide to kill mosquitoes; and diagnostic blood testing of children under five with fever. The survey gathers additional information on indoor residual spraying (IRS), and background data on the characteristics of household members and ownership of household assets such as electricity, bicycles, radios, and indoor plumbing.

Multiple Indicator Cluster Surveys: Multiple Indicator Cluster Surveys, known as MICS, have become the largest source of statistically sound and internationally comparable data on women and children worldwide. Trained fieldwork teams conduct face-to-face interviews with household members on a variety of topics – focusing mainly on those issues that directly affect the lives of children and women. MICS was a major source of data on the Millennium Development Goals (MDG) indicators and will continue to be a major data source during the 2030 Sustainable Development Agenda to measure Sustainable Development Goals (SDGs) indicators.

Service Availability and Readiness Assessment Survey: The Service Availability and Readiness Assessment Survey (SARA) is designed as a systematic survey to generate a set of tracer indicators of service availability and readiness. The survey objective is to generate reliable and regular information on service delivery (such as the availability of key human and infrastructure resources), on the availability of basic equipment, basic amenities, essential medicines, and diagnostic capacities, and on the readiness of health facilities to provide basic health-care interventions relating to family planning, child health services, basic and comprehensive emergency obstetric care, HIV, TB, malaria, and non-communicable diseases.

Joint External Evaluation (JEE) Survey: The Joint External Evaluation (JEE) is a voluntary, collaborative process to assess a country's capacity under the International Health Regulations (2005) (IHR) to prevent, detect, and rapidly respond to public health threats whether occurring naturally or due to deliberate or accidental events. The JEE allows countries to identify the most urgent needs within their health security system; to prioritize opportunities for enhanced preparedness, response and action; and to engage with current and prospective donors and partners to target resources effectively.

Aggregate Open Data Sources

WHO Global Health Observatory: The WHO Global Health Observatory covers global health priorities such as the health-related Millennium Development Goals, mortality and burden of disease, health systems, environmental health, noncommunicable diseases, infectious diseases, health equity and violence and injuries. The WHO Global Health Observatory includes the Global Reference List of 100 Core Health Indicators, which is a standard set of 100 indicators prioritized by the global community to provide concise information on the health situation and trends, including responses at national and global levels. It is reviewed and updated periodically as global and country priorities evolve and measurement methods improve.

United Nations Data Catalogue: The purpose of the Data Catalogue is to promote the sharing and publishing of open data, so as to improve the availability and accessibility of information across the organizations and entities that comprise the UN system. The Data Catalogue is uniquely placed to provide a single interface for finding, analysing and working with UN data. While there are several other data platforms, many of which host United Nations data, the catalogue exclusively brings together all open UN data collections in one place, even though they may be published elsewhere. Anyone searching for UN data today has to look in many places and make separate searches on several different platforms. The Data Catalogue addresses this limitation.

Humanitarian Data Exchange: The Humanitarian Data Exchange (HDX) is an open platform for sharing data, launched in July 2014. The goal of HDX is to make humanitarian data easy to find and use for analysis. The growing collection of datasets has been accessed by users in over 200 countries and territories. A team within the United Nations Office for the Coordination of Humanitarian Affairs (OCHA) manages HDX. OCHA is part of the United Nations Secretariat, responsible for bringing together humanitarian actors to ensure a coherent response to emergencies. The HDX team includes OCHA staff and a number of consultants, which are based in North America, Europe and Africa.

Malaria Atlas Project: The Malaria Atlas Project aims to disseminate free, accurate and up-to-date information on malaria and associated topics, organised on a geographical basis.

Mapping Malaria Risk in Africa Database: The Mapping Malaria Risk in Africa (MARA) Collaboration was initiated in 1996 to provide an accurate atlas of malaria risk for sub-Saharan Africa. The aim of the project is to generate and present malaria risk maps and relevant information in a way that it is most useful for the implementation of malaria control activities across the continent. MARA is being maintained by the Swiss Tropical and Public Health Institute (Swiss TPH) in Basel, Switzerland, in collaboration with the Medical Research Council (MRC) in Durban. Malaria-relevant information has been constantly updated and to date, over 13 000 data points have been collected from published and unpublished sources, through literature searches and country visits. MARA is an open-access and user-friendly internet-based platform to extract and display raw malariometric data, with a strong emphasis on prevalence data. The MARA database constitutes a precious global resource in view of the rapid expansion of malaria control activities and the need to provide both a solid epidemiological baseline and an update on the situation as control proceeds.

AfriStat: AfriStat is an online data catalogue that contains statistical data for member states, including Benin, Burkina Faso, Burundi, Cabo Verde, Cameroon, Central African Republic, Chad Comoros, Congo, Cote d'Ivoire, Equatorial, Guinea, Gabon, Guinea Guinea-Bissau, Mali, Mauritania, Niger, Senegal and Togo. Data that is contained within the catalogue includes agriculture, commodities, economics, education, environment, fertilizers, gender, health, infrastructure, international trade, mortality, ODA, PMAESA, port statistics and poverty.

Alternative Data Sources

WorldPop: The WorldPop project was initiated in October 2013 to combine the AfriPop, AsiaPop and AmeriPop population mapping projects. It aims to provide an open access archive of spatial demographic datasets for Central and South America, Africa and Asia to support development, disaster response and health applications. The methods used are designed with full open access and operational application in mind, using transparent, fully documented and peer-reviewed methods to produce easily updatable maps with accompanying metadata and measures of uncertainty.

OpenWeatherMap: OpenWeatherMap allows access to current weather data for any location for over 200,000 cities, which could prove useful for disease surveillance and forecasting models. The weather data is frequently updated based on global models and data from more than 40,000 weather stations. The Data is available in JSON, XML, or HTML format, and is available for free. It has been acknowledged that weather conditions and health are intrinsically intertwined with health data and information providing useful insights on how climate change impacts on public health. The effects of changes in weather affect directly and indirectly human health. These changes could include heat waves and precipitation resulting in rising sea-levels, flooding and droughts, hurricanes, air pollution, diseases carried by vectors, and food and water-borne illnesses. The effective use and application of weather data using OpenWeatherMap makes it possible to apply climate information to support decision making in climate adaptation and risk management in the health sector. The use of such information to health could lead to the prediction of significant climate variations in relation to health effects and the provision of solutions to minimize or avoid adverse health effects.

Relevant Projects and Initiatives as Data sources

It is noted here that a number of relevant projects and initiatives highlighted in the preceding section are also considered as potential data sources, such as the Regional Programme for Support to Pandemic Prevention in the ECOWAS Region, the Sahel Women's Empowerment and Demographic Dividend Project, the Systems for Improved Access to Pharmaceuticals and Services Program etc. They have, however, not been included in this section in order to avoid duplication or repetition.

4.1.5 Policy Review

The policy review section of the landscape analysis related to sub-purpose 1 focused predominantly on the West Africa region, due to the fact that sub-purpose 1 was more of a priority for WAHO than it was for IGAD at the time of review. The policy review for sub-purpose 1 therefore sought to address the following questions relevant to the policy environment in which RAD will be implemented:

- What role do regional and international bodies play in policymaking related to cross-border data sharing, Integrated Disease Surveillance and Response (IDSR), and migration?
- How will current national policies impact the ability of countries to participate in, collaborate on, and contribute to a regional data sharing and analytical tool?
- How will current national policies impact the design of a RAD tool to encourage and facilitate data for decision making?
- How will current national policies and laws, particularly as related to IDSR, migration, and the One Health Approach, impact the ability of countries to utilize the RAD tool to improve health outcomes?

4.1.5.1. Findings: Regional Actors

Policies Relevant for Cross-border Data Sharing

International laws or agreements have guided the development of regional and national health IT legislation. Though mostly non-binding, these international frameworks have provided a model with which countries can align their policies. The European Union's 1995 Data Protection Directive (95/46/EC), for instance, has been a boilerplate for most Sub-Saharan regional data-related legislation.

Regional organizations also largely influence cross-border data sharing and eHealth policies through agreements and inter-regional collaboration initiatives. Whilst they provide member states significant leeway to adopt and shape policies, these agreements tend to have weak enforcement mechanisms. Nevertheless, regional bodies play a critical role by fostering partnerships, setting and defining actionable targets, and mobilizing resources for regional needs. For example, the Economic Community of West African States (ECOWAS), and its special institution responsible for health-related topics, the West African Health Organization (WAHO), have together moved forward the creation of an open-source, District Health Information System (DHIS2)⁶ software, such that it is currently used by 14 out of 15 WAHO member states. Similarly, both ECOWAS (2010) and the African Union (AU) (2014) have passed regional agreements on data protection. To date, four ECOWAS member states have ratified or signed the AU Convention on Cyber Security and Personal Data Protection, while by 2015, six countries have enacted legislation that complies with the Supplementary Act on Personal Data Protection within ECOWAS.

⁶ Cross, C., Omoluabi, E., Oucho, J. & Cibangu, F.K. (2006) Synthesis and conclusions: what are Africa's issues in migration? In: Cross, C., Gelderblom, D., Roux, N. & Mafukidze, J. (eds). Views on migration in Sub-Saharan Africa: proceedings of an African migration alliance workshop. Cape Town: HSRC Press. 245-289

Policies Related to Disease Surveillance and Response

For disease surveillance and response, international bodies have partnered with regional organizations to implement policies and procedures that have had a significant impact on country-level activities. For instance, the World Health Organization's (WHO) Integrated Disease Surveillance and Response (IDSR) framework, adopted in the late 1990s, contributed significantly to disease surveillance policies globally and domestically. The goal of IDSR is to strengthen the capacity of country systems for surveillance and response while ensuring country stewardship of this process. Over the last two decades, 43 of the 46 countries in the WHO Africa region have started to implement the IDSR guidelines. The IDSR guidelines are in line with the International Health Regulations (IHR) (2005), which are currently binding to all 194 countries of the WHO. Each state has the discretion to determine how to implement IHR provisions, which creates considerable latitude for compliance. As a result, the role of IHR is more of a guidance document than a legally binding agreement.

Policies Related to Migration

Migration policies are of relevance to the work of RAD due to the frequent movement of persons across international borders in the ECOWAS region and the fact that diseases cross borders freely. Both the AU and ECOWAS have established laws that could impact the development of a RAD product. In the context of establishing a regional economic zone, ECOWAS has adopted a protocol which calls for the "free movement of persons and for the harmonization of national policies."⁹ The AU has also implemented two major migration frameworks which call for, among other things, free movement of persons, healthcare provision for migrants, refugees, and displaced persons, strengthening of research and data collection within and between countries, supporting the establishment of Health and Social Affairs Desks at regional economic communities to harmonize policies on cross-border health issues,¹⁰ and the conducting of research on underlying health problems of migrant populations.¹¹

4.1.5.2. Findings: National Policies

RAD's approach and product design will consider the national policy landscape of WAHO member countries. The following sections examine policies in the three countries in which the RAD team has undertaken country stakeholder engagements: Togo, Ghana, and Cote d'Ivoire.

Policies Related to Data Sharing

A survey of policies in Togo, Ghana, and Cote d'Ivoire found a relative absence of laws or policies directly related to cross-border sharing of data. However, countries have shared data with their neighbours. For example, Ghana and Cote d'Ivoire are both part of Abidjan – Lagos Corridor Organization, which was established by five West African heads of state to provide cross-border response to the spread of HIV/AIDS as well as to promote the free movement of people and goods. Togo was part of a regional informational sharing workshop for the support of operationalizing vocational trading policies among ten African countries. This history of data sharing suggests that in the absence of formal policies, these governments largely take a pragmatic approach to data sharing with other countries or regional entities: countries are willing to share their data when a tangible benefit for doing so exists.

⁹ <http://www.unhcr.org/49e47c8f11.pdf>

¹⁰ <http://www.unhcr.org/protection/migration/4d5258abg/african-union-migration-policy-framework-africa.html>

¹¹ http://www.un.org/en/africa/osaa/pdf/au/cap_migrationanddev_2006.pdf

Policies Related to Data for Decision Making

Both Ghana and Cote d'Ivoire have systems in place that encourage the use of data for decision making. Cote d'Ivoire's national strategic plan seeks to strengthen community-based immunization monitoring to provide data that will improve vaccine availability. Ghana has created an eHealth vision which seeks to ensure that routine data is reported within 24 hours of capture and that there is real time reporting of notifiable diseases.¹² However, both countries have also cited challenges in implementing these programs due to poor data quality. Cote d'Ivoire has cited issues with data storage and analysis, as well as coordination within and between sectors which impedes the quality of data available for decision making.¹³ Limited information was available for Togo in this respect.

Policies Related to Disease Response & Surveillance

As outlined above, most countries in the region have implemented the IDSR to some degree. Policies that extend beyond the IDSR exist in the countries surveyed, but each country has seen challenges in their implementation. Togo, for example, has developed a series of fragmented policies and programs to address various health outbreaks as they have occurred.^{14,15,16} While likely effective in addressing the targeted condition, the number of projects aimed at individual diseases indicates a need for a more systematic, proactive approach to disease surveillance and outbreak. Cote d'Ivoire has created a national health plan that includes a strategy to strengthen response mechanisms in outbreaks; however, it lacks a multi-sectoral component¹⁷.

At the cross-border level, countries are making progress, but continue to see gaps in coordination and communication within and between countries as it relates to surveillance. A lack of policy for sharing data and information across borders and between surveillance systems has complicated the work. Countries have coordinated their activities through donor funded projects, such as the World Bank-funded West Africa Regional Disease Surveillance Systems Enhancement Project (WARDS), which supported all the ECOWAS member states¹⁸ and is now succeeded by the Regional Disease Surveillance Systems Enhancement Project (REDISSE).¹⁹

Policies Related to Migration

WAHO member states appear to have a varied degree of policy focus on health migration. Ghana launched a National Migration Policy and implementation plan in 2016, which advocates for the need to mitigate health risks associated with migration while at the same time promoting the gainful opportunities that result from migration.²⁰ Togo, which sees considerable immigration and emigration, lacks a comprehensive health migration policy. , Côte d'Ivoire also lacks a comprehensive policy.^{21,22} However, the country's National Development Plan includes goals to remedy this situation by establishing both a general migration plan and a migration and development policy, as well as a National Migration Office.^{23,24}

¹² World Health Organization. (2017). Joint External Evaluation of IHR Core Capacities of the Republic of Côte d'Ivoire. 1-59. License: CC BY-NC-SA 3.0 IGO.

¹³ World Health Organization. (2017). Joint External Evaluation of IHR Core Capacities of the Republic of Côte d'Ivoire. 1-59. License: CC BY-NC-SA 3.0 IGO.

¹⁴ Togo: Ebola Virus Disease Preparedness - Emergency Plan of Action (EPoA). (n.d.). Retrieved August 14, 2017, from <https://www.humanitarianresponse.info/en/operations/togo/document/togo-ebola-virus-disease-preparedness-emergency-plan-action-epoa-n%C2%Bo>

¹⁵ Togo: Meningitis epidemic - Emergency Plan of Action (EPoA) DREF operation n° MDRTGoo6 Final Report. (2016, September 29). [Text]. Retrieved from <http://reliefweb.int/report/togo/togo-meningitis-epidemic-emergency-plan-action-epoa-dref-operation-n-mdrtgoo6-final>

¹⁶ Maman, I., Badziklou, K., Landoh, E. D., Halatoko, A. W., Nzussouo, T. N., Defang, G. N., ... Kere, A. B. (2014). Implementation of Influenza-like illness Sentinel Surveillance in Togo. BMC Public Health, 14, 981. <https://doi.org/10.1186/1471-2458-14-981>

¹⁷ Republique de Côte d'Ivoire. (2016). Plan National de Developpement Sanitaire 2016-2020. 13-59.

¹⁸ <http://documents.worldbank.org/curated/en/502731496523660158/pdf/ISR-Disclosable-P125018-06-03-2017-1496523650954.pdf>

¹⁹ <http://documents.worldbank.org/curated/en/502731496523660158/pdf/ISR-Disclosable-P125018-06-03-2017-1496523650954.pdf>

²⁰ Ghana National Migration Policy for Ghana. 2016 <http://migratingoutofpoverty.dfid.gov.uk/files/file.php?name=national-migration-policy-for-ghana.pdf&site=354> <https://www.iom.int/news/ghana-launches-national-migration-policy>

²¹ Togo. (n.d.). Retrieved August 14, 2017, from http://www.un.org/en/development/desa/population/migration/events/other/workshop/2015/docs/Workshop2015_Togo_Migration_Fact_Sheet.pdf

²² Togo. (n.d.). Retrieved August 14, 2017, from http://www.un.org/en/development/desa/population/migration/events/other/workshop/2015/docs/Workshop2015_Togo_Migration_Fact_Sheet.pdf

²³ Devillard, A., Bacchi, A., & Noack, M. (2016). A Survey on Migration Policies in West Africa. 125-141.

²⁴ World Trade Organization Secretariat. (2012). Trade Policy Review: Côte d'Ivoire, Guinea-Bissau and Togo. 91-167.

Policies Related to One Health Approach

One Health is a multi-disciplinary approach to health that recognizes the connectedness among human, animal, and environmental health, and advocates working with physicians, veterinarians, ecologists, and other relevant health personnel to improve human health²⁵ It considers how human, animal, and environmental health can collectively affect public health issues.²⁶ Combining human and animal health systems is a cost-effective way for countries to track and prevent disease, and can be a tool for strengthening the entire health system.²⁷ The three countries examined are utilizing, to various degrees, principles of One Health: Ghana is in the process of developing a comprehensive action plan and Côte d'Ivoire and Togo utilize the One Health approach in health-related initiatives, but do not yet have a formal framework for implementation. The USAID Preparedness and Response project is working with partners in Cote d'Ivoire using One Health, to include the creation of steering and technical committees and a multi-sectoral technical secretariat. The recently established Public Health Emergency Operations Centre is part of the planned platform.²⁸

4.1.6 Considerations

User Needs

The mandate of WAHO and IGAD are to support their sovereign member states to maintain and improve public health. It is therefore important to understand, how RAD can support the RECs to provide value at the national level: In each country, the team found a slightly different emphasis with regards to health priorities and management challenges, which was to a large extent a function of the specific stakeholders met, which varied between countries depending on their availability. Based on an overall review, it appears that health problems, as well as the related underlying resource- and management challenges are similar across different contexts on the continent.

Thematically, surveillance of epidemic-prone diseases was of a high importance in all countries, and maternal death was described as a top-priority for the leadership in Uganda and Côte d'Ivoire. Other RAD domains (reproductive health, malaria and TB) all play an important role in public health in all countries.

Operationally, insufficient human resources and challenges with supply management were most frequently mentioned as challenges that concern all the different domains. The need to improve the quality of routine health data and an improved coordination between donor-funded activities were other problems that were highlighted in all the visited countries.

The team only met one director of a finance department (in Togo). She described a problem that may be less expected in a setting with resource constraints but could constitute an interesting future opportunity for RAD: The insufficient absorption of allocated funds.

To understand the kind of information that is useful for country-level decision makers, it may be helpful to categorize the challenges into three classes, and find ways to provide information that either helps to diagnose the problem or identify solutions for each of the three categories (Table 5)

²⁵ <https://www.cdc.gov/onehealth/basics/index.html>

²⁶ One Health Basics | One Health | CDC. (2017, August 4). Retrieved from <https://www.cdc.gov/onehealth/basics/index.html>

²⁷ Dean, A. S., Bonfoh, B., Kulo, A. E., Boukaya, G. A., Amidou, M., Hattendorf, J., ... Schelling, E. (2013). Epidemiology of Brucellosis and Q Fever in Linked Human and Animal Populations in Northern Togo. PLOS ONE, 8(8), e71501. <https://doi.org/10.1371/journal.pone.0071501>

²⁸ <http://preparednessandresponse.org/countries/155/>

Decision-making and information products: The country visits showed that while there are universal planning and management procedures, there seems to also be a unique decision-making culture in each country, which varies in the level of inclusiveness and use of evidence. The rapid country visits do not allow for general conclusions, but they did leave the impression that Ghana and Uganda each have their very own way of using evidence in a structured manner, while in Côte d'Ivoire and Togo the use of evidence may be more dynamic and situational. Additionally, in the latter two countries, there might be a somewhat more centralized “top-down” approach to decision making than in the former.

RAD information products should be made useful for review meetings and for thematic situational updates. They could include standard templates for review meetings on maternal mortality, immunization, malaria, and TB programmes, with visualizations that can be easily inserted in a PowerPoint presentation or a Word Document. Information that is directly relevant for annual budgeting and planning meetings (e.g. information that helps making decisions on priorities for resource allocation) are likely to have an impact, as does information that helps decision-makers to quickly quantify or understand a problem or find new solutions.

Table 11: Classification of country-level challenges and needs

	Subcategory	Examples	Information should help to...
Health problems	Poor health indicators and health events	<ul style="list-style-type: none"> High maternal or neonatal death rate Meningitis or cholera outbreaks Emergence of drug-resistant pathogens 	<p>Diagnose the problem:</p> <ul style="list-style-type: none"> Detect deviations from norms or targets Quantify a problem, compare and prioritize Understand the underlying reasons <p>Solve the problem:</p> <ul style="list-style-type: none"> Evaluate and compare different measures
	Determinants of Health	<ul style="list-style-type: none"> Low contraceptive use or skipping of ANC Outbreak of highly pathogenic avian influenza High pesticide concentration in soil 	
Resource shortage	Financial shortage	<ul style="list-style-type: none"> Lack of refrigerators in health facilities Insufficient funds for immunization outreach sessions 	<p>Diagnose the problem:</p> <ul style="list-style-type: none"> Quantify the gaps <p>Solve the problem:</p> <ul style="list-style-type: none"> Convince decision-makers to avail resources Suggest optimal allocation of funds and HR Identify and pool skilled professionals Pool resources (e.g. supply management)
	Human resource shortage	<ul style="list-style-type: none"> Lack of expertise to set up laboratory information system Not enough time to validate routine service data 	
Planning and execution	Suboptimal processes and execution	<ul style="list-style-type: none"> Stock-out of vaccines Lack of funds absorption Non-rational use of medicine 	<p>Diagnose the problem:</p> <ul style="list-style-type: none"> Monitor and document execution slippages Highlight insufficient funds absorption <p>Solve the problem:</p> <ul style="list-style-type: none"> Show opportunities to increase efficiencies Identify potential new approaches (e.g. good practices) Evaluate and compare solutions Quantify the cost and cost-benefit
	Dysfunctional overall approach	<ul style="list-style-type: none"> Blood shortage Ineffective pharmacovigilance 	

How regional data can help with national problems: The mandates of IGAD, WAHO and RAD are of a regional nature, and the data aggregation and analysis assume a perspective that goes beyond the confines of individual countries. Since ultimately, the regional organisations (or the secretariat, in the case of IGAD) were created to serve the constituents of the respective economic communities, the country visit sought to understand health priorities, decision-making processes and the data ecosystem in member countries at the national level. To unite the regional and the national perspectives, it is important to understand how data and insights from the region can provide value for individual member states. The following list describes some ways in which the regional data could serve national interests:

- The comparison of national health- and health system indicators with other countries in the region (and with the regional average) helps to detect where the country has a specific problem. Comparison of indicators may also motivate action, in the spirit of a friendly competition.
- Regional data on disease surveillance allows the detection of threats from suspect and confirmed cases and outbreaks in neighbouring countries.
- Information on good practices and experiences with planning or resource allocation in other countries can be applied in the national context (typical questions to peers in regional meetings are “how did you do X?” “How did you deal with Z?”).
- Insights through research and data analysis at the national level in one country may apply in another country as well. A regional body can therefore support national-level data analytics with a regional benefit and can help to disseminate findings from the national context in the region.
- Sharing on information related to needs for medical supplies and stock-levels (for example vaccines, laboratory reagents or family planning supplies) could result in a de-facto pooling of resources and mutual support in cases of acute shortages.
- The regional bodies need to monitor the health, resource, and execution problems across the sub-region to
 - (1) detect common problems that require joint action and resource mobilization and
 - (2) to identify countries with exceptional problems so that the community can assist these countries with expertise and resources.

The aggregation of data from multiple countries allows for meta-analysis with higher statistical power, and thus enables regional bodies to gain new insights about problems or solutions that can be shared with their constituents.

Information Products and Data Sources

An analysis of existing information products and data sources suggests that the RAD project could consider contributing to the regional needs in several ways. **For the weekly epidemiological bulletin, such considerations could include, for example:**

- Making a repository of all national weekly epidemiological bulletins available for public access.
- Encouraging and supporting countries in the set-up and activation of an API between the national and regional systems, which would result in increased timeliness of the regional bulletin, as well as reduced workload at the national and regional level.
- Integrating Laboratory Information Systems (LIS) into the IDSR and DHIS 2 systems, as levels of reporting and accountability for LIS data is currently low.
- Including more sub-national outbreak information, such as district level case fatality and attack rate data, while highlighting affected border districts through map-based visualizations.
- Overlaying and analysing additional indicators for affected and neighbouring districts, especially in border regions, considering indicators such as population density, immunization coverage, latrine coverage, road infrastructure, stock levels, health facilities, staffing, service readiness etc.
- Including key results of the most recent GHSA Joint External Evaluations (JEE) for countries affected by an outbreak in order to provide context when reporting.
- Integrating risk profile data for affected and neighbouring districts into bulletins.
- Introducing and displaying thresholds to indicate when the case fatality rate (CFR) or attack rate of an outbreak exceeds the expected levels associated with an appropriate response, to allow partners and neighbouring countries to take additional measures and provide support to their neighbour when required.

In addition to the above, discussions with stakeholders during the Cote d'Ivoire site assessment suggest that the WAHO weekly epidemiological bulletin is not well known and disseminated throughout all countries. The identification and listing of all interested stakeholders in national and sub-national organizations and partner institutions, direct email dissemination from WAHO to a broad list of recipients, as well as an opportunity for interested parties to subscribe to the bulletin online, could increase the visibility and utilization of the publication. Such increased visibility may result in increased motivation for countries to provide surveillance data on a timelier basis and in a format requiring less manual processing by WAHO, such as the potential automated transfer from national DHIS2 systems to the WAHO instance.

For the quarterly health bulletin and the annual health profile, such considerations could include, for example:

- Emulating the approach of the RMNCH scorecard with subnational indicators showing where improvements need to be made.
- Making it easier to do regional comparisons in WAHO using an intuitive visual platform.
- Malaria already has some level of subnational reporting in the WHO reports with maps of incidence regions and parasite prevalence. RAD could combine this with related metrics that are updated annually.
- In TB, there are strong reporting structures in place (although there may be a need for more automated and direct data transfer from laboratories to systems like DHIS2). RAD could look into possibilities of relating TB reporting data to data on resource allocation and service statistics
- RAD can collaborate with existing initiatives that seek to strengthen the data pipeline and warehousing to benefit from their efforts to access data. This includes existing national-level efforts of health data warehousing, including the WHO initiative on National Health Observatories in Africa.

Existing Projects and Initiatives

Through the activities of the landscape analysis, a number of existing projects, initiatives and subsequent organizations were uncovered, which were of relevance to sub-purpose 1 and the RAD project in general. As previously mentioned, a purpose of the landscape analysis is to learn from existing projects and initiatives; to ensure that efforts are complementary and not duplicative; and ultimately, to collaborate where possible. Projects, initiatives and/or organizations considered for immediate collaboration are included in the table below.

Table 12: Projects, initiatives and/or organizations considered for immediate collaboration

Organisation	Region	Description	Benefit of collaboration ²⁹
World Health Organization: Health observatories, IDSR, IRIS, GHSA	Sub-Saharan Africa	WHO has several existing initiatives to collect and analyse data at the global, regional (AFRO) and national level that have a functional overlap with RAD, and manage several relevant programs, such as the health emergencies program. These can be leveraged and complemented. Duplication needs to be avoided.	<ul style="list-style-type: none"> Access to data, professional networks and enhanced global credibility Increased utilization of data and translation to action, visibility and validation of health observatory initiative
African Union: CARMMA, Africa CDC, Agenda 2063	Sub-Saharan Africa	AU is the umbrella organization of states and RECs on the continent and has ongoing initiatives related to disease control and maternal and child health. Africa CDC is a public health institute established by the African Union (AU). Agenda 2063 is a strategic framework for the socio-economic transformation of the continent over the next 50 years.	<ul style="list-style-type: none"> Visibility and potential uptake on the continent beyond WAHO and IGAD and enhanced buy-in by African governments Access to data, support of organisational agenda and better linkage to national governments and technocrats
APHRC: MEP, Africa Data Revolution, Academic research and networks	Sub-Saharan Africa	As a Pan-African, reputable academic research institution, APHRC had a leading role in efforts related to the 'African Data Revolution' (Statistics for Development). The institution is well networked with academic institutions and with funders of knowledge translation initiatives globally and has a broad health systems expertise.	<ul style="list-style-type: none"> Access to knowledge and social networks related to statistical agencies and open data including UN World Data Forum and PARIS21, academic health sector expertise Possibility to influence policy and access decision makers at the national and regional level in Africa
BlueSquare: DHIS2 Plugin and RBF data	Sub-Saharan Africa	Based on experience in building data visualization for results-based financing for World Bank projects, BlueSquare evolved to offer add-on software to DHIS2 including a public-facing data visualization interface, a feedback loop to health workers, and a user-interface to build custom algorithms for data analysis.	<ul style="list-style-type: none"> National-level relationships in nearly 20 African countries, DHIS2-related expertise and software development and RBF data Access to regional bodies (WAHO and IGAD) and enhanced visibility of work portfolio in the international development community
The Core Group: IGAD border-regions	East Africa	The Core Group coordinates the activities of a group of NGOs in multiple IGAD border regions related to Polio routine immunization and campaigns with an added focus on pastoralist communities and immunization outreach activities.	<ul style="list-style-type: none"> Access to knowledge, data and key contact persons related to immunization activities in border sites in the IGAD region, potential to accelerate scale-up Better use of existing data and support in data management.

²⁹ First bullet point is benefit to RAD, second bullet point is benefit for partner.

Projects, initiatives and/or organizations that are considered to have good potential for near-future strategic cooperation are included in the table below.

Table 13: Projects, initiatives and/or organizations considered for near-future strategic cooperation

Organisation	Region	Description	Benefit of collaboration ²⁹
Health Data Collaborative	Sub-Saharan Africa	The HDC is a joint effort by multiple global health partners to establish a network of working groups that will address specific technical issues and identify and fill technical gaps. The working groups develop standards, indicators and other tools that help countries to collect, analyse and use good health data.	<ul style="list-style-type: none"> • Visibility of RAD within health data community of practice; access to domain expertise and technical input • Reactivation of the "Data analytics and use" technical working group
University of Oslo and HISP	Sub-Saharan Africa	HISP is a global movement to strengthen Health Information Systems in Developing countries. The University of Oslo is the leading organisation and supports capacity building and implementation support, research, and hosting the core DHIS2 software development team.	<ul style="list-style-type: none"> • Understanding of status of DHIS2 development across countries, expertise and national-level contacts • Enhanced value of national HIS systems through linkage to action
International Development Research Centre (IDRC)	East & West Africa	Through their Innovating for Maternal and Child Health in Africa (IMCHA) programme, IDRC support implementation research and knowledge-to-practice for MCH in both West and East Africa, in collaboration with WAHO, APHRC and other organisations. IDRC also support statistics for development and development research in Africa beyond IMCHA.	<ul style="list-style-type: none"> • Access to cutting-edge implementation research related to MCH and research teams across Africa; existing consortium of research institutions, statistics for development actors, and potentially funding sources • Enhanced visibility of research findings and access to decision makers at national and regional levels
Support to Pandemic Prevention in the ECOWAS Region (RPPP) Project, funded by the German Development Cooperation GIZ	West Africa	The RPPP project supports the three post-Ebola countries and Nigeria in several aspects of pandemic prevention including risk communication, media monitoring, and IT capacity, and support for the regional rapid response team (ERIRE). GIZ also supports the testing of SORMAS in Nigeria and possibly Ghana, a disease surveillance and response information system.	<ul style="list-style-type: none"> • Access to media and social media monitoring data; enhanced national and regional utilization of the RAD platform to inform risk communication and outbreak rapid response. Possible access to real-time surveillance data in SORMAS pilot regions, • Enhanced value of media monitoring data; strategic information for risk monitoring and rapid response
Abidjan-Lagos Corridor Organisation (ALCO)	West Africa	ALCO is a sub-regional institution engaged in the prevention, management and treatment of STI / HIV / AIDS and in facilitating the free movement of people and goods along the transport corridor from Lagos to Abidjan (crossing through Benin, Togo and Ghana).	<ul style="list-style-type: none"> • Acceleration in the set-up of regulatory frameworks/MoU for cross-border information sharing; national-level relationships, access to data collected under ALCO projects • Increased regional visibility and added value to existing data
Countdown 2030	Sub-Saharan Africa	Countdown to 2030 tracks coverage levels for health interventions proven to reduce maternal, new-born and child mortality. Countdown has gathered and synthesised data on intervention coverage and its key determinants, and regularly disseminated country profiles, synthesis reports, scientific articles, and in-depth country analyses	<ul style="list-style-type: none"> • Access to MCH data aggregated by the initiative, access to MCH data community of practices and academic networks • Access to collaboration with WAHO, data collected under RAD, and increased visibility at the national level

Organisation	Region	Description	Benefit of collaboration ²⁹
Intrahealth iHRIS	Sub-Saharan Africa	iHRIS is IntraHealth International's free, open source software, designed to help countries to track and manage their health workforce data to improve access to services. Multiple countries in Africa use it to capture and maintain information for health workforce planning, management, regulation, and training.	<ul style="list-style-type: none"> National-level contacts for HRH data and technical advice on automated access to iHRIS system Added value to iHRIS system through data utilization, evidence-based influence on HRH policy decisions
Global Fund (IGAD and WAHO projects)	East & West Africa	The largest health-related project currently implemented by IGAD is funded by the Global Fund and related to the diagnostic and control of TB and HIV in a number of refugee camps in the region. Global Fund financed activities across Africa regularly generate and submit data and (to a lesser extent) operational research to the organisation.	<ul style="list-style-type: none"> Influence on design of data collection tools and access to data of IGAD refugee camps; access to GF programme data from both regions Strengthened sense for evidence-based decision making at the national level; complimentary data and insights from RAD to inform funding decisions
Better Immunization Data Initiative (PATH)	East & West Africa	The BID Initiative is based on the assumption that better data, plus better decisions, will lead to better health outcomes. The initiative developed an electronic immunization registry, which automatically sends information to a tablet device, in terms of how many children are due for vaccines, which immunizations they need, and how much vaccine stock and supplies the clinic needs.	<ul style="list-style-type: none"> Access to immunization-related data and multi-country experience/expertise Increased utilization of data generated or aggregated under BID and visibility of the initiative's efforts among policy-makers
Preparedness and Response Project (DAI)	West Africa	The DAI Preparedness and Response Program works in 5 ECOWAS countries (Cote D'Ivoire, Guinea, Liberia, Mali and Sierra Leone), in order to strengthen national systems, policies and practices for the prevention, detection and response to public health threats.	<ul style="list-style-type: none"> Improved basis for multi-sectorial data-sharing and collection of animal and environmental health data at the national level in relevant countries Visibility of project efforts and successes
EPT2 – One Health Workforce (University of Minnesota)	Sub-Saharan Africa	The OHW project, funded under the USAID EPT2 programme, seeks to employ the strengths of universities to prepare the "One Health" workforce in core competencies and skills for preventing, controlling, detecting and responding to zoonotic diseases.	<ul style="list-style-type: none"> Access to academicians for research-to-practice aspect of RAD and access to One Health expertise Visibility of project efforts and successes and improved access to regional/national policy makers
ECOWAS regional institutions: rCDC and Regional Animal Health Centre	West Africa	The regional centre for disease control (rCDC) and the RAHC are being set up – both in their very early stage – as independent organisations under ECOWAS and will have an important role in disease surveillance for human and animal health.	<ul style="list-style-type: none"> Access to data and potential users of RAD-generated insights for decision making Access to strategic information and data relevant to decision-making
Afya Research Africa	East Africa	Afya Research Africa received a grant under the County Innovation Challenge Fund (CICF) in Kenya to create a digital connection between the existing array of health providers in Turkana, to enable unique identification of patients who move from one facility to the next in the pastoralist setting. This will improve quality of care and reduce loss to follow-up.	<ul style="list-style-type: none"> Joint learning and harmonization of activities in the development of unique identifiers and digital systems to improve continuity of care for pastoralist populations
CB-HIPP Project (FHI360)	East Africa	CB-HIPP provides health services in border areas and transport corridor sites, such as the Malaba and Busia border regions between Kenya and Uganda and is therefore of relevance to the RAD project from a learning and potential collaboration point of view, in terms of a client-provider level digital solution.	<ul style="list-style-type: none"> Relationships and existing collaboration mechanisms at the Kenya/Uganda border, learning from past project activities (successes and failures) Visibility of project efforts and successes and improved access to regional/national policy makers

Projects, initiatives and/or organizations that are considered as a resource for information, contacts, data, expertise and/or potential for future partnership are highlighted below.

Key international organizations that generate relevant data and have national-level activities and relationships:

- The World Bank Group (REDISSE, Service Delivery Indicators and other data collection and aggregation activities)
 - African Development Bank (Open Government Data activities)
 - World Animal Health Organization (OIE)
-

Specialized agencies of the United Nations that generate relevant data and/or support statistics for development:

- United Nations Organisation for the Coordination of Humanitarian Affairs (UNOCHA)
 - United Nations Economic Commission for Africa (UNECA)
 - United Nations Office for Project Services (UNOPS)
 - United Nations High Commission for Refugees (UNHCR)
 - Food and Agriculture Organisation (FAO)
 - International Organization for Migration (IOM)
 - United Nations Data Catalogue - a product of multiple UN organisations
-

Donor-funded initiatives:

- Reproductive Health Supplies Coalition
 - IDRISI initiative in IGAD (funded by GIZ in East Africa)
-

Private and nongovernmental institutions with relevant activities and products:

- Institute for Health Metrics and Evaluation (IHME)
 - CIVICUS
 - Strathmore University
 - BAO Systems
 - SACIDS – One Health Research Network
 - IBM Research Lab
 - DataScience Ltd.
 - Clinton Health Access Initiative (CHAI)
-

Policy

Based upon the policy analysis, there are potential opportunities and scope for the RAD initiative to complement the activities of WAHO and its member states in several areas:

- **Leverage existing frameworks to demonstrate the value of collated regional data:** Building on other sector examples, existing projects, and leveraging national frameworks for data sharing, RAD can work with WAHO to show the value of collated regional data to countries. WAHO's work with the Abidjan-Lagos Corridor Organization's Joint Regional Project for the Prevention and Management of STI/HIV/AIDS, and particularly its focus on data synchronization and configuration, can serve as one such model. For the RAD project, the visualization and analysis of multiple data sets in the proposed enhanced regional epidemiological bulletin could create country demand for data and incentivize countries to share more data sets with WAHO.
- **Support One Health development to align country approaches:** The countries surveyed in this review were in early stages of integrating One Health approaches into their national policies. The emergent nature of these policies offers the RAD consortium and its partners an opportunity to support WAHO member countries in creating aligned approaches to One Health-related data policy and to multi-sector integration, which is necessary for successful One Health implementation. This opportunity can provide RAD and WAHO with more robust data, which will in turn improve the data analysis and tools that WAHO provides member states.
- **Build on DHIS2 development to align country approaches:** The region-wide momentum towards use of the DHIS2 provides the RAD project with an opportunity to build on an already existent tool to increase the use of data for decision making. With momentum towards use of one regional tool, RAD and WAHO can demonstrate the utility of aligned data collection and storage policies to both WAHO member countries, and to external organizations and donors, ideally reducing data collection and reporting burdens of individual countries.
- **Utilize WAHO regional expertise and relationships to navigate complex policy environments:** WAHO's decades of experience present a learning opportunity for the RAD consortium. Gaps in national regulatory environments, which could create legal uncertainties and hinder RAD's ability to design, pilot, and scale its solution, can be navigated more easily in partnership with the ongoing counsel of WAHO in liaison with its member countries.
- **Support the development of formal frameworks and mechanisms that encourage the use of data for decision making:** Building on the WAHO Resolution on Use of Evidence in Developing Health Care Policies, Plans, Standards, and Protocols in the ECOWAS Region, drafted in June 2017, the RAD project can support WAHO and its member states in developing frameworks and mechanisms that encourage member states to take up the WAHO resolution, and to utilize the collection of more timely and actionable data that can be translated into evidence to support improved policymaking and practice.

4.2 Sub-Purpose Two

4.2.1. User Needs

WAHO: During the stakeholder engagements, WAHO highlighted that its priority need at the health facility level is service availability mapping within border regions to support outbreak management. WAHO leadership and the RAD team agreed that this priority will be explored at a later stage of the project.

IGAD: IGAD leadership and the RAD team decided that the focus for year two would be on the development of a client-provider level solution. Therefore, at the client-provider level, IGAD's primary need is the development of a digital solution to improve continuity of care across international borders for cross-border mobile populations, including pastoralists. The initial focus of this solution will be immunization and MNCH.

The reason behind IGAD's focus on cross-border populations and immunization is threefold. First, due to the fact that resolving issues affecting cross-border populations lies solely within IGAD's mandate there is no overlap with existing health programs from any of its member states. Secondly, immunization data is less sensitive than data from other health areas i.e. TB and HIV/AIDS. Finally, IGAD is focused on the comparatively low vaccination coverage among refugee populations and pastoralists within its member states. IGAD has indicated that pilot countries for the RAD project are the border regions between Kenya and Uganda, as well as Ethiopia and Sudan. Kenya and Uganda, members of the EAC are also members of the Intergovernmental Authority on Development (IGAD).

4.2.2. Policy Review

The policy review for sub-purpose 2 sought to address the following questions relevant to the policy environment in which RAD will be implemented:

- What role do international and regional bodies play in determining cross-border data sharing, digital health, migration, and immunization policies?
- How will current national policies and strategies impact the implementation of a cross-border digital health solution at the client-provider, or service delivery, level?
- What policy and guideline implementation opportunities exist at the at sub-national level that RAD can leverage to improve implementation?

4.2.2.1. Findings: Regional and International Actors

The support provided to countries by regional and international bodies creates direct and indirect levers for these actors to shape the adoption and implementation of policies. Regional organizations can influence national policies through the binding nature of membership.³¹ IGAD's establishment agreement, for example, includes provisions to shape and harmonize policies across the region, including in the social, technological and scientific fields, as well as trade, customs, transport, communications, agriculture, and natural resources.³² The following sections outline ways in which regional and international players have influenced policy development in areas of particular relevance to the RAD initiative.

³¹ Constitutive Act of the African Union. Sect. Article 23 - Impositions of Sanctions 2000.

³² Intergovernmental Authority of Development (1996). "Agreement Establishing the Intergovernmental Authority on Development". Nairobi, Kenya.

Policies Related to Digital Health and Cross-border Data Sharing

International frameworks have guided the development of regional and national digital health legislation. International laws or agreements have provided a model with which countries can align their policies. The European Union's 1995 Data Protection Directive (95/46/EC), for instance, has been utilized as a guide for most Sub-Saharan regional data-related legislation.³³ Regional bodies largely influence digital health policies through agreements and collaborative initiatives. While providing member states with significant leeway to adopt and shape policies, these agreements tend to have weak enforcement mechanisms. Nevertheless, regional bodies play a critical role by fostering partnerships, setting and defining actionable targets, and mobilizing resources for regional needs. These bodies have passed resolutions focused on data privacy, protection, and harmonization of data frameworks that have begun to have an influence on country-level policy. A goal of IGAD's Data Sharing Agreement is to establish and consolidate formal institutional linkages for data sharing between IGAD and member states' national statistics offices.³⁴ Likewise, the Africa Centres for Disease Control and Protection's Statute stipulates that member states facilitate easy access to health information through the establishment of a continental framework for data sharing.³⁵ Its Regional Collaborating Centres will work with national public health institutes to establish a mechanism for exchanging surveillance data across the region.³⁶ The African Union has also passed a regional agreement on data protection as well as a harmonized data regulatory framework, which has guided member countries in developing national legislation.³⁷ Ultimately though, regional organizations defer to member countries to authorize the transfer of personal data across borders. When countries lack these policies, it can result in difficulties in data sharing.³⁸ Countries subject to overlapping regional and international agreements must also cope with a lack of clarity around which frameworks take precedence.³⁹

Policies Related to Migration

Migration policies, while not directly related to health systems strengthening, are of importance to the work of RAD due to the cross-border nature of the populations targeted by the initiative. A review of regional organizations' activities found that they actively establish and promote policies and recommendations for their partner states with regards to migration. IGAD's establishment clause mandates that it promote the free movement of goods, services, and people and the establishment of residence.⁴⁰ The group recommends a number of strategies to its member states, including assisting refugees and internally displaced persons in getting access to health services in refugee camp settings.⁴¹ The African Union Agenda 2063, which is modelled on the Sustainable Development Goals and which was developed in cooperation with the United Nations, addresses the need to regulate migration flows, but also to respect the rights of migrants. It calls on countries to increase international cooperation to address migration related issues, particularly when it comes to women, youth, and vulnerable groups. The Agenda also proposes the idea of a unified Africa with regional integration, including a continent wide visa regime.⁴² The African Union has implemented two other major migration frameworks, which call for, among other things: healthcare provision for migrants, refugees, and displaced persons; strengthening of research and data collection within and between countries; and supporting the establishment of health and social affairs desks at regional economic communities to harmonize policies on cross-border health issues.^{43,44}

³³ United Nations Conference on Trade and Development (2016). "Data Protection Regulations and International Data Flows: Implications for Trade and Development." Geneva, Switzerland. Retrieved from: http://unctad.org/en/PublicationsLibrary/dt1stict2016d1_en.pdf.

³⁴ IGAD (2017) "IGAD Members Consult on Data Sharing Agreement". <https://igad.int/divisions/economic-cooperation-and-social-development>

³⁵ Africa Centres for Disease Control and Protection (2016). Statute of the African Centres for Disease Control and Prevention.

³⁶ Africa Centres for Disease Control and Prevention (2017). "Africa Centres for Disease Control and Prevention's Regional Collaborating Centres in Africa agree on a strategic plan and roadmap for disease prevention and response in Africa". Retrieved from: <https://au.int/en/pressreleases/20170320/africa-centres-disease-control-and-prevention%E2%80%99s-regional-collaborating>

³⁷ African Union (2014). The African Union Convention on Cyber Security and Personal Data. Retrieved from: <https://au.int/en/treaties/african-union-convention-cyber-security-and-personal-data-protection>

³⁸ Woolfrey L. An Open African Data Approach to Improving Data Quality [Internet]. DataFirst Data Service, University of Cape Town; Report No.: PB 14/42. Retrieved from: <http://www.dpru.uct.ac>

³⁹ United Nations Conference on Trade and Development (2016). "Data Protection Regulations and International Data Flows: Implications for Trade and Development." Geneva, Switzerland. Retrieved from: http://unctad.org/en/PublicationsLibrary/dt1stict2016d1_en.pdf.

⁴⁰ Intergovernmental Authority of Development (1996). "Agreement Establishing the Intergovernmental Authority on Development". Nairobi, Kenya.

⁴¹ Intergovernmental Authority of Development (2015). IGAD Social Development Strategy and Implementation Plan 2016-2020, Volume One: The Framework.

⁴² http://www.un.org/en/development/desa/population/migration/events/coordination/14/documents/backgrounddocs/OSAA_14CM.pdf

⁴³ African Union Executive Council (2006). The Migration Policy Framework for Africa. Retrieved from: <http://www.unhcr.org/protection/migration/4d5258ab9/african-union-migration-policy-framework-africa.html>

⁴⁴ African Union (2006). African Common Position on Migration and Development. Retrieved from: http://www.un.org/en/africa/osaa/pdf/au/cap_migrationanddev_2006.pdf

Policies Related to Immunization

On January 31st, 2017, African leaders endorsed the Addis Declaration on Immunization at an African Union Summit with the goal of achieving universal access to immunization by 2020. This historical pledge received support from political leaders at the highest level.⁴⁵ The declaration underlines the great importance that regional and international bodies place on immunization, as demonstrated by programmatic support from organizations such as the World Health Organization (WHO) Africa and policy guidance from regional organizations such as the East African Community (EAC).^{46,47}

While not currently operating in the IGAD region, of note is the Bill and Melinda Gates Foundation funded BID Initiative, which is creating national electronic registries for Tanzania and Zambia in close collaboration with the respective ministries of health. BID leadership plans to expand the initiative into additional countries in the future. One activity will add a barcode to national paper-based Child's Clinic Cards with a 'regional/global' link such that selected information could be viewed by health care providers in other countries when a child migrates.⁴⁸

4.2.2.2. Findings: National Policies and Practices

The following sections examine policies in four IGAD member countries: Kenya, Uganda, Ethiopia, and Sudan.

Information and Communications and Technology (ICT)

Countries use oversight organizations, such as Sudan's National Telecommunications Corporation (NTC),⁴⁹ and policies, such as Ethiopia's National Information and Communication Technology Policy and Strategy (2016), to increase access to ICT resources for their citizens. Sudan's NTC regulates pricing and encourages providers to sign agreements to provide international roaming services.⁵⁰ Uganda's guiding policy principles include enhancing public-private partnerships to increase delivery of infrastructure and services. In Kenya, the government has introduced several initiatives aimed at increasing access to ICT, including the National Optic Fibre Backbone Infrastructure project, which will expand coverage to all 47 counties in the country by the end of 2017. In addition to work focused on expanding ICT coverage, countries have implemented policies to protect their citizen's data, health related and otherwise, as illustrated in the table below.

Table 14: Data Storage and Security Policies, by country

Ethiopia	Kenya	Sudan	Uganda
National ICT policy includes plans to establish ICT standards and guidelines, and legal and regulatory systems. It also includes a plan to develop a legal framework to enforce an electronic archive.	Kenya's mHealth and EMR Guidelines prohibit the storage of health data outside Kenya without written permission from the Ministry of Health.	The Informatics Offences Act of 2007 outlines specific information and data security breaches through electronic systems that are cited as offences and punishable under Sudanese Law.	According the Data Protection and Privacy Bill, 2015, data processed outside Uganda should be done within a jurisdiction that provides at least the equivalent or higher data protection measures as those provided in the Bill.
Ethiopia drafted a data protection law in 2009 focused on protecting personal data.	EMR systems must have built in security controls.		
	The National HIS and eHealth Policy indicate that all facilities shall be responsible for safe storage and easy retrieval for all records under their care.		The Data Protection and Privacy Bill, 2015 further provides guidance around security safeguards for data controllers or processors.

⁴⁵ The Gavi Alliance (2017). "African Heads of State Make Historic Commitment on Immunisation" Retrieved from: <http://www.gavi.org/library/news/gavi-features/2017/african-heads-of-state-make-historic-commitment-on-immunisation/>

⁴⁶ African Vaccination Week. <http://www.african-vaccination-week.afro.who.int/en/>

⁴⁷ East African Community. (2016). The EAC Child Policy (2016) Retrieved from: <http://ovcsupport.org/wpcontent/uploads/2017/04/FinalEACChildRightsPolicy2016.pdf>

⁴⁸ BID Initiative. Retrieved from: <http://bidinitiative.org/>

⁴⁹ ITU (2015). National and International Roaming: NTC Role and Challenges. Retrieved August 24, 2017, from: <https://www.itu.int/en/ITU-D/Regional-Presence/ArabStates/Documents/events/2015/RM/Presentations/Session7/NTC-Sudan.pdf>

⁵⁰ Ministry of Information and Communications Technology, Republic of Uganda (2014). "National Information and Communications Technology Policy for Uganda" https://www.ict.go.ug/sites/default/files/Resource/ICT_Policy_2014.pdf

Relevant Aspects of National Digital Health and Health Information System (HIS) Strategies

All four of the countries surveyed have developed digital health strategies,^{51,52,53} which include embedded strategies for telemedicine and HIS or, in the case of Kenya and Ethiopia⁵⁴ separate policies focused on these areas. Of relevance to the RAD initiative, Ethiopia's 2016 Information Revolution Roadmap includes as goals strengthening of community HIS, creating a separate HIS for pastoral communities, promoting a biometric data recording system for mobile communities, and developing standard recording and reporting protocols for compatibility with the community HIS.⁵⁵ In addition to its ambitious five year digital health plan, Uganda has innovated in this realm with the Uganda Health Information Network, which allows health care workers to use personal digital assistants (PDAs) to collect patient information and share it centrally.⁵⁶

Challenges vary across countries, but common obstacles include the need for further skilled personnel, particularly in community-based health facilities, as well as limited computer literacy among health care workers.^{57,58} Further challenges are related to data quality, and countries are responding with policies to ensure that the data they receive is reliable, as seen in the table below.

Table 15: Data Governance Policies, by country

Ethiopia	Kenya	Sudan	Uganda
<p>Ethiopia's policies seek to improve evidence-based decision-making and information sharing; through integrating data and information systems; and consistent procedures and standards for data management across institutions.</p> <p>Ethiopia plans to develop a standard data management system, which will contribute to the development of health data quality assurance mechanisms.</p>	<p>The Kenya HIS Data Quality Assurance protocol provides a framework and uniform approach, to be applied through the entire data collection and management process, in which all stakeholders and partners shall be committed to ensuring data quality (at all levels) for planning and decision making.</p>	<p>The National Health Research Policy 2016 aims to redirect health research towards strengthening the health system by improved management and increased investment in the health research system.</p>	<p>Uganda's National eHealth Strategic plan captures the eHealth governance vision and aims more broadly.</p> <p>In 2010, the MOH developed Standard Operating Procedures (SOPs) for Health Information to aid in standardizing data system management, to improve complete recording of health data, and provide detailed guidelines on how to access, collect, and share health data.</p>

⁵¹Federal Ministry of Health. (2014). Ethiopian National eHealth Strategy. Retrieved from: http://www.who.int/goe/policies/ethiopian_ehealth_strategy2014.pdf?ua=1.

⁵²Ahmed, E. E. (2011). Revisiting eHealth in Sudan. Ministry of Health. Retrieved from <http://www.ph.edu.sd/Newsletter/TheEvidence1.pdf>

⁵³ Kenyan Ministry of Medical Services (2011). The Kenyan e-Health Strategy 2011-2017. Retrieved from: https://www.isfeth.org/files/media/kenya_national_ehealth_strategy_2011-2017.pdf

⁵⁴ Ethiopian Federal Ministry of Health. (2016). Information Revolution Roadmap. Retrieved from: <http://www.moh.gov.et/web/guest/-/information-revolution-roadmap?inheritRedirect=true>.

⁵⁵ Ethiopian Federal Ministry of Health. (2016). Information Revolution Roadmap. Retrieved from: <http://www.moh.gov.et/web/guest/-/information-revolution-roadmap?inheritRedirect=true>

⁵⁶ Vital Wave Consulting (2009). Health Information Systems in Developing Countries: A landscape analysis.

⁵⁷ Farah, S. K. S. (2011). Challenges and Opportunities of Integrating Primary Health Care Information System: Northern State, Sudan. Retrieved from <https://www.duo.uio.no/handle/10852/30022>

⁵⁸ Farah, S. K. S. (2011). Challenges and Opportunities of Integrating Primary Health Care Information System: Northern State, Sudan. Retrieved from <https://www.duo.uio.no/handle/10852/30022>.

Data Sharing Policies and Practices

Cross-border Data Sharing

Although there has been little formal policy-making in the area of cross-border health data sharing in the countries surveyed, all four have been engaged in cross-border initiatives that indicate a willingness to collaborate with other countries when there is obvious tangible benefit. For example, all four countries have taken part in a 2012 WHO and CORE Group Polio cross-border initiative to coordinate efforts to eradicate polio in the region, particularly in border areas.⁵⁹ Similarly, country representatives at the RAD-IGAD Decision Point Meeting held in September 2017 shared that they have existing formal data sharing efforts in the areas of HIV and TB. They also mentioned the role that Joint Border Committees have played in Ethiopia and Sudan for information sharing related to security issues. Further policy developments in this area are described in the table below.

Table 16: Cross-border Data Sharing Policies, by country

Ethiopia	Kenya	Sudan	Uganda
<p>Draft Data Protection Law will include provisions for privacy regarding cross-border data sharing.</p> <p>Ethiopia participated in Integrated Programme for Sustainable Peace and Socio-economic Transformation: Marsabit County, Kenya and Borana Zone, Ethiopia.</p>	<p>No clearly defined policy on cross border data sharing was found. However, under article, 118 of the establishment of the East African Community (EAC), Kenya agreed to promote the exchange of information on health issues to achieve quality health within the community.</p> <p>Any agreements for cross-border collaboration has to pass through the country's attorney general for legal input.</p>	<p>Sudan's participation in 2016 meeting with Ethiopian leaders led to MoU to develop cooperation framework for disease surveillance/ control, sharing of animal health and trade information.</p>	<p>Though cross border data sharing policies are not in place yet, one of the objectives of the National ICT Policy is to develop international standards for health data sharing with due consideration to privacy concerns.</p>

⁵⁹ Okiror, S.O., Kisanga, A., and Bhui, B.R. (2015). Cross-border initiative on polio eradication in the Horn of Africa. Retrieved from: <https://www.who.int/sites/default/files/ahm/pages/2551/AHM%2019%20-%202016%20-%20Cross-border%20initiative%20on%20polio%20eradication%20in%20the%20Horn%20of%20Africa.pdf>

Intra-country Data Sharing

All four countries surveyed have systems in place for the collection of data at the local level.^{60,61,62,63,64} Both Sudan and Kenya have recently undergone decentralization of their health care systems, with some transition challenges. Sudan sees little coordination between its different healthcare levels for data collection and transmission.⁶⁵ Kenya has seen challenges in redistributing data analysis to the local levels that collect and transmit raw data to central offices.⁶⁶ As part of the Information Revolution Roadmap, the Ethiopian government plans to increase intra-country data sharing with the development of a Master Facility Registry, a centralized, open-source data collection, storage, and distribution system that is integrated with the various systems used by different stakeholders.⁶⁷ The Kenyan Ministry of Health has begun creating an interoperability architecture for the country.⁶⁸ Countries, such as Uganda, still need to pass interoperability architecture specifications.⁶⁹ Relevant policies identified in this area are summarized in the table below (table 17).

Table 17: Intra-Country Data Sharing Policies, by country

Ethiopia	Kenya	Sudan	Uganda
The country's policies to facilitate data sharing between institutions in the country focus on making all the eHealth systems interoperable, and to integrate them into the overall HIS.	Counties can make their own laws regarding the HIS systems but the National HIS Policy encourages feedback loops at all levels. To encourage data use, there are information sharing forums at the National and County level. Public data is also shared via the Kenya Open Data Initiative (http://www.opendata.go.ke/) which gives citizens' rights to government information.	No citations found yet pointing to intra-country data sharing policies.	The Open Data Policy draft (May 2017) aims to make public sector data open by default with exceptions on personal identifiable data and data with security, IP rights, commercial and environmental restrictions.

⁶⁰ Farid, I. M. F. (2008). Development of a model for healthcare service quality: an application to the private healthcare sector in Egypt. Maastricht School of Management, The Netherlands. Retrieved from <http://www.msm.nl/~msmnl/resources/uploads/2013/10/Appendix-12a-Fikry.pdf>

⁶¹ Federal Democratic Republic of Ethiopia Ministry of Health. (2012). National Health Information System Road Map. Retrieved from: <http://www.moh.gov.et/web/guest/-/national-health-information-system-strategic-plan?inheritRedirect=true>.

⁶² Foster, Rosemary (2012). Review of Developing Country Health Information. Retrieved from: http://www.hiwiki.org/PHTF/images/e/e2/R_Foster_HEA_Review.pdf

⁶³ Kenya Ministry of Health (2010). The Policy Environment (Situational Analysis). Health Sector Health Information System Policy 2010-2030. Ministry of Health

⁶⁴ Isabel Brodsky, Akaco Ekirapa, Molly Cannon, and Tara Nutley (2016). Understanding Data Demand and Use in Kenya. Successes and Challenges in Kakamega, Kilifi, and Kisumu Counties

⁶⁵ Farah, S. K. S. (2011). Challenges and Opportunities of Integrating Primary Health Care Information System: Northern State, Sudan. Retrieved from <https://www.duo.uio.no/handle/10852/30022>

⁶⁶ Bwana, M.K & Maina, I (2016). A county view opportunities and challenges of decentralized data driven decision making [Power Slides]. Retrieved from <http://www.who.int/servicedeliverysafety/events/S3-Kenya.ppt?ua=1>

⁶⁷ Ethiopian Federal Ministry of Health. (2016). Information Revolution Roadmap. Retrieved from: <http://www.moh.gov.et/web/guest/-/information-revolution-roadmap?inheritRedirect=true>.

⁶⁸ Steven Wanyee (2017). Report on Enabling Environment for Healthcare Information, Communications and Technology in Kenya.

⁶⁹ Steven Wanyee (2017). Report on Enabling Environment for Healthcare Information, Communications and Technology in Uganda.

Patient-Level Data Sharing

The countries surveyed have varying levels of data protection and sharing policies focused at the patient level. In a study, Sudanese patients cited the insufficiency of patient data safety and confidentiality policies.⁷⁰ The Ethiopian Information Revolution Roadmap includes patient privacy and confidentiality as a goal, with a key activity of developing ethical standards to protect patient privacy and security.⁷¹ In Uganda, the guiding policy priorities include equitable access to health information and services as well as the right of access to health information.⁷² The Kenyan government has innovated in this respect as a result of the 2010 constitution, which gives citizens a right to government information. This policy has been actualized through the Kenya Open Data Initiative, the first such program in sub-Saharan Africa.⁷³

The table below describes policy developments in this area further.

Table 18: Patient Confidentiality Policies, by country

Ethiopia	Kenya	Sudan	Uganda
<p>The Information Revolution Roadmap aims to develop ethical standards to protect patient privacy and security as it pertains to health information access.</p> <p>The country's legal framework protects the privacy of individual data and provides patients with access to their data.</p>	<p>The Health ACT 2017* (enacted into law but not in force) protects the privacy and confidentiality of patient records. Information may only be disclosed by patient written consent, a justifiable court order or law, or where non-disclosure of such information represents a serious threat to public health.</p> <p>Data collected by the health sector should be non-patient identifiable.</p>	<p>International standards for consent, confidentiality and access to personal data (such as OECD Guidelines on the Protection of Privacy) are applied during collection of health-related data.</p>	<p>Uganda's Patients' Charter provides for disclosure of patient information only after informed consent, except when it is required by law.</p> <p>Information pertaining to the patient's treatment can be shared if vital to the protection of the public, or for research provided all identifying details are omitted.</p> <p>Identifiable patient data is not shared unless it's for referral purposes.</p>

⁷⁰ Salih El Zaki, D. (n.d.). E-Health in Sudan: Case Study. Retrieved from: <https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=3&cad=rja&uact=8&ved=0ahUKewjc5OinzevVAhWF4SYKHUvLABsQFggvMAI&url=https%3A%2F%2Fwww.itu.int%2Fen%2FITU-T%2FWorkshops-and-Seminars%2FHealth%2F201302%2FDocuments%2FS2P1-Daliya-Salih.pptx&usq=AFQJCNFrFsgVHG9o6aPZhd-32h0OmjiVmA>

⁷¹ Ethiopian Federal Ministry of Health. (2016). Information Revolution Roadmap. Retrieved from: <http://www.moh.gov.et/web/guest/-/information-revolution-roadmap?inheritRedirect=true>.

⁷² Omaswa, C. (2013). Uganda National eHealth Policy.

⁷³ Kenya ICT Authority. <http://www.opendata.go.ke/>

Immunization Policies and Practices

All four countries surveyed have implemented country-level Expanded Programs on Immunization (EPI), as recommended by WHO. In Sudan, the program has been successful with 90% of children receiving routine immunizations. One significant Sudanese innovation involved the training of volunteer vaccinators from targeted ethnic groups to reach 80% of nomadic children.⁷⁴ Ethiopia also provides outreach and mobile services, targeting pastoral communities with persistently low immunization coverage and focused efforts on social mobilization in pastoralist regions.⁷⁵ The country uses supplemental immunization activities focused on diseases that affect specific areas of the country, usually cross-border regions and areas with large refugee populations. Ethiopia also includes non-citizen populations, such as refugees and asylum seekers, in its immunization initiatives. Similarly, the Ugandan immunization policy of 2012 has as a goal to “streamline cross-border collaboration on issues regarding immunization” and is inclusive in language stating “people living in Uganda” should be covered, rather than “citizens of Uganda”.⁷⁶ In spite of the above implementation successes, there are still challenges linked to health services for cross border populations, which the RAD project envisions to address. The challenges include disease outbreaks such as the 2014 polio outbreak of wild poliovirus type 1 (WPV1) in the Horn of Africa, poor tracking of clients hindering the continuity of care due to the poorly maintained immunization registers, poor quantification of supplies due to inadequate inventories and inaccurate estimates due to the “influx” of population from neighbouring countries which makes it difficult for facilities in border regions to plan their drug stock and requisitions well, leading to stock-outs and the absence of clear identification systems across countries in the IGAD region. The RAD project presents an opportunity to track immunization and guide and inform better decision making particularly among mobile cross border populations, which RAD intends to do through deployment of Client-Provider solutions with an initial focus on immunization.

Immigration, Citizenship, and Cross-border Population Policies and Practices

Uganda is a signatory to the African Union Convention for the Protection and Assistance of Internally Displaced Persons in Africa convention, which legally binds governments to protect refugees in their borders.⁷⁷ Neither the governments of Kenya nor Sudan have yet ratified the convention. Ethiopia has signed it, but is not yet legally bound by it.⁷⁸ As such, it is not clear how active the governments are in following its recommendations.⁷⁹ In Sudan, the international community unsuccessfully tries to fill the health care provision gap, meeting only about 22% of the actual need of refugees.⁸⁰ Ethiopia’s Refugee Proclamation of 2004 includes provisions for refugee rights which copy those in the convention. However, the proclamation does not contain provisions specific to the Ethiopian context nor a specific implementation framework.⁸¹ Of note, the Kenyan Public Health Acts give the Minister of Health authority to regulate immigration and importation into the country for preventing the introduction of infectious diseases.⁸²

⁷⁴ WHO. Strengthening routine immunization in Sudan. (n.d.). Retrieved August 24, 2017, from http://www.who.int/features/2013/sudan_immunization/en/

⁷⁵ Federal Ministry of Health. (2015). Ethiopia National Expanded Programme on Immunization. Retrieved from: http://www.nationalplanningcycles.org/sites/default/files/country_docs/Ethiopia/ethiop_cmyp_latest_revised_may_12_2015.pdf

⁷⁶ Uganda Ministry of Health. (2012). Uganda Immunisation Policy. Retrieved from: http://www.nationalplanningcycles.org/sites/default/files/planning_cycle_repository/uganda/epi_policy_-_final.pdf

⁷⁷ Internal Displacement Monitoring Center. “The Kampala Convention Two Years On: Time to Turn Theory into Practice” Retrieved from: <http://www.internal-displacement.org/sub-saharan-africa/kampala-convention/>

⁷⁸ Ibid.

⁷⁹ Press Release on the Ratification of the African Union Convention for the Protection and Assistance of Internally Displaced Persons in Africa (Kampala Convention) by the Republic of Congo / Press Releases / ACHPR. (n.d.). Retrieved August 24, 2017, from <http://www.achpr.org/press/2015/01/d247/>

⁸⁰ Sudan Tribune. “Sudan Hosts 2 Million Refugees”. (n.d.). Retrieved from <http://sudantribune.com/spip.php?article63307>

⁸¹ Federal Democratic Republic of Ethiopia. (2004). Refugee Proclamation No. 209/2004. Retrieved from: <https://chilot.me/2011/08/29/refugee-proclamation-no-4092004/>.

⁸² Public Health Act of 1986, 16 Laws of Kenya, Cap. 242 (rev. ed. 2012)

Pastoralist and Semi-Nomadic Communities

Many of the border areas which will be a focus of the RAD initiative are inhabited by pastoralist and semi-nomadic communities. Hence, it is important that the RAD initiative consider the sociocultural and health systems context of these communities and their unique challenges. Countries in the region have a mixed history of dealing with pastoralist needs in the policymaking realm. The Ethiopian government began incorporating pastoralist community concerns into policy with its 1995 constitution and has continued to include pastoralist community concerns in its national development plans for 2000-2004 and for 2005-2009.⁸³ The Kenyan and Ugandan constitutions do not yet have provisions on pastoralism.⁸⁴ However, the government of Kenya created the Ministry of State for Development of Northern Kenya and other Arid Lands in 2008, which has as its focus a region of the country dominated by pastoralists.⁸⁵

4.2.3. Cross-border Context

In terms of uniquely identifying their populations, like many countries across the globe, ECOWAS and IGAD regions use a standard national identification of issuing personal identification numbers linked to recorded events, such as a birth record, age achieved, or some form of system registration. However, in some countries these civil registration processes have limited reach. In addition, most countries issue national identification documents for administrative use only after a person turns either 16 or 18 years of age. The absence of a regionally (cross national) issued unique identifier makes tracking of local and mobile cross-border populations particularly difficult. From our research we can conclude that at present there is no common definition of who is part of a cross-border population in either East or West Africa, and the variables to identify individuals as being from cross-border populations depend on prospective tracking rather than retrospective identification.

It was found that there are several reasons that drive people to cross borders in East and West Africa and these can be grouped into three major categories; socio, economic and security. The continent's population growth, along with poverty levels, climate change and continuing or new conflicts over resources and boundaries, continue to push people to move.

Four key migration flows dominate:

- Labour emigration to outside sub-Saharan Africa (mainly West and Central Africa to North Africa and the Gulf)
- Refugees within IGAD member states and increasingly in West Africa
- Labour migration within ECOWAS and IGAD member states and to Southern Africa, and
- "Clandestine migration" within and from the ECOWAS and IGAD region, such as human trafficking and child economic migration.¹

A USAID funded project (CB-HIPP) concluded that there is no single push or pull factor for mobility in the area. Rather, mobility in the region is driven by an interplay of a myriad of drivers—porous borders; kinship ties, including multiple registration on each side of the border; an anonymity factor; social engagements; and diverse formal and informal economic opportunities and shared amenities in health, entertainment and the faith community.

⁸³ Yimer, Mohammed (2015). Pastoral Development Pathways in Ethiopia; the Policy Environment and Critical Constraints. Retrieved from: https://sustainabledevelopment.un.org/content/documents/5789pastoralism_development_pathways_rev2.pdf

⁸⁴ Regional Pastoral Livelihood Advocacy Project. (n.d.) Pastoralist Policies and Practice. Retrieved from: http://www.fao.org/fileadmin/user_upload/drought/docs/3%20Policies%20and%20Practice.pdf

⁸⁵ Elmi, Mohamed and Izzy Birch (2013). "Creating Policy Space for Pastoralism in Kenya". Retrieved from: <http://www.future-agricultures.org/publications/research-and-analysis/working-papers/1747-creating-policy-space-for-pastoralism-in-kenya/file>

The regional bodies of West and East Africa along with the African Union have in the last few decades recognised the importance of movement across national borders in promoting trade across the regions. The main economic migration destinations in West Africa as of 2012 were Nigeria and Gabon, while in East Africa they were Kenya and Tanzania.²

Within the ECOWAS region, the Protocol on Free Movement of Persons, Right of Residence and Establishment (1975, revised 1986) allows all ECOWAS member nationals the right to work and live in another ECOWAS state for up to 90 days. A common passport was introduced in 2000, with a special document for nomadic herders authorising regular cross-border movement beyond the 90 days. From 2017 the region is shifting from the common passport to a biometric identification card.³ The African Union unveiled a common 'All-Africa' passport in July 2016,⁴ though the timeline for implementation remains unclear.

Each country in the West and East African region has a combination of paper and electronic system capturing aggregate data from health facilities. Most countries use DHIS2 as the national platform for collecting, analysing and reporting on national program indicators. These are detailed further in the eHealth profiling findings of this report.

At a regional level in West Africa, WAHO collates aggregate data from member countries, but this is a limited dataset and does not include patient identifiable data. Currently, WAHO has data on all notifiable diseases and the rest of the indicators are not yet populated by member states. In East Africa, health data collection on a regional level is less formally collated but is available via Ministries of Health and large donors such as USAID. IGAD does not have regional system for collecting health related data, but the East African community uses DHIS2 for collecting health-related data from members states.

Having established the broader context of population migration and unique identification in the West and East African Regions, the RAD project narrowed the focus of the landscape analysis to the IGAD identified initial site of the Kenya/Uganda border of Malaba. Based on research carried out by the USAID funded CB-HIPP project that is working with cross-border populations in the area, 31% of Kenyan health facilities that were inventoried and 30% of Uganda facilities reported making cross-border referrals for healthcare. In addition, 95% of healthcare providers in Kenya and 94% in Uganda report that they treat patients from outside their country⁵.

The concern around this population mobility in relation to the uptake of health services is that the two countries health systems are designed for national populations in their use of national guidelines, reporting tools, and referral and follow-up mechanisms. "There is a lack of formal cross-border facility-to-facility linkage, no formal patient cross-border referral and tracing mechanism, and a lack of regional guidance on health issues for cross-border mobile populations." As a result, health outcomes are likely to be compromised by missed appointments; repetitive or inconsistent diagnostics, poor treatment adherence; multiple registrations of maternal, neonatal and child health clients; loss-to-follow-up, and so on⁶. It is important to note however, that the CB-HIPP project focused on HIV-AIDS services along selected cross border-areas in East Africa.

In designing solutions for the RAD project will conduct an ethnographic assessment of the implementation area (district) in relation to health seeking behaviour for immunization services and technology to acquire an in depth understanding of how local people in the implementation area engage with health services for immunization and technology use. Following the ethnographic assessment, the process of solution socialization will commence based on the findings. The outputs of the solution socialization activities will be a set of adaptable promotional materials that can be adjusted (for language etc.) used in future implementations.

Relevant Projects and Initiatives

Sub-purpose 2 is more of a priority for IGAD than it is for WAHO, and IGAD's priority health area is MNCH. As a result, a significant portion of the projects and initiatives, which are of relevance to sub-purpose 2 and the RAD project, focus on MNCH and cover the East Africa region. Such projects and initiatives can be found in the table below.

Table 19: Existing projects and initiatives relevant to sub-purpose 2.

Projects and Initiatives	Region	Thematic Area	Partner
CORE Polio Program	East Africa	MNCH	CRS
Cross-Border Health Integrated Partnership Project	East Africa	MNCH, FP, Malaria, TB	FHI360
Challenge TB	East Africa	TB	KNCV TB Foundation
North Star Alliance Initiative	East Africa	MNCH, FP, Malaria, TB	North Star Alliance
PACT-VIH	West Africa	HIV/AIDS	FHI360

Core Polio Program: The purpose of the Core Polio Program is to contribute towards the National Polio Eradication Initiative in the border, pastoralist and hard to reach woredas (districts), and prevent the importation and circulation of Wild Polio Virus from neighbouring countries. It is currently being implemented in Ethiopia, Kenya, Somalia and South Sudan, and is of relevance to the RAD project because it is a cross-border, client-provider level project in the IGAD region focused on immunization, without a digital patient tracking system.

Cross-Border Health Integrated Partnership Project: The goal of the Cross-Border Health Integrated Partnership Project is to extend and provide quality integrated health services in strategic border areas and other transport corridor sites. It is currently being implemented in Kenya and Uganda in the Malaba and Busia border regions and is of relevance to the RAD project because it is a cross-border, client-provider level project in the IGAD region, focused on integrated health services, including MNCH and TB, without a digital patient tracking system.

Challenge TB: The purpose of the Challenge TB project is to enhance cross border TB control by promoting cross-country collaboration and coordination for improved TB control and surveillance across national borders. It is currently being implemented in Ethiopia, Kenya, Somalia, and Uganda, and is of relevance to the RAD project because it is a cross-border, client-provider level project in the IGAD region, focused on TB, and without a digital patient tracking system.

North Star Alliance: The North Star Alliance initiative exists to provide quality healthcare to mobile workers and the communities they interact with through clinics that are located at 'hotspots' such as border posts, transit towns or ports. It is currently being implemented in Kenya and Uganda along the Malaba border and is of relevance to the RAD project because it is a cross-border, client-provider level project in IGAD region, focused on integrated health services, including MNCH and TB, with an established digital patient tracking system.

PACT-VIH: The Regional HIV/AIDS Prevention and Care project, known in west Africa as PACTE-VIH, addresses the critical gaps in programming for key populations — specifically female sex workers and their clients, and men who have sex with men — across West Africa. The ultimate goal of this project is to build support for HIV programs that are evidence-based, adaptable, replicable and transferrable across the region. It does this by focusing on interventions that are designed to build governmental political will to engage key stakeholders in advancing such programs. PACT-VIH works along the Abidjan-Lagos corridor in cross-border regions and has exposure to using unique identifiers to track patients for the purpose of continuity of care.

Patient Identification and Available Technologies

Most Governments are issuing national IDs through their respective national ID agencies. National ID agencies within member states are beginning to collaborate (through WAHO and IGAD programs) on a single regional identification system but there are no specified time lines for any given solution and it can be assumed that such a roll out will take many years to implement across regions. In addition, each country's authority has specific ideas about what should be considered the norm for identification - be it fingerprint, facial recognition etc. Most countries will provision these identification cards to carry a multitude of services - including health, banking, motor vehicle, civil registration, etc with the intention being to have a one card system within the country whereby a civilian can transact with multiple public institutes. National ID agencies are required to protect their citizen information. There is no common method or standards for interrogating national ID databases across the region. Only some data is exposed to a limited number of private institutions such as telecoms for SIM card registration.

Two civil authorities that were interviewed were developing technology that allowed third parties to interrogate their platforms for public services, and were willing to work with their respective health departments to provide unique identification of local citizens if requested. For an immunization solution to be developed such integration could prove invaluable, however, there is still a long way before citizens are all issued with the ID cards. The framework for the RAD project technical solution would need to ensure that when these services were available and online, whatever solution was deployed, have the ability to integrate in the future with such authorities, and migrate civil authentication to institutionalized services that would be better suited to deliver and manage card distribution etc.

The landscape analysis has shown that at this early stage of requirements gathering, it is not yet possible to define a single solution that will cater for the needs of both the East and West Africa Regions. Although technology is typically able to fulfil most requirements, the question is not what type of technology to deploy, but whether there is an appropriate, sustainable and implementable solution that fulfils the requirements of the RAD project for the regions.

Further investigation will be required once more regional information is available to define an appropriate solution to cater for cross-border immunization tracking.

Existing Health Technologies and Solutions

Sub-purpose 2 involves developing a digital solution that allows for the collection of client-provider level data in border regions, for the purpose of continuity of care across international borders. It was therefore pertinent to investigate existing solutions that potentially allow for the collection of client-provider level data in border regions, for the purpose of continuity of care across international borders in the IGAD region. Based on a desk review, the RAD project identified a number of open source and proprietary point-of-care systems that could be used for the RAD health facility level immunisation solution. These systems were identified based on their appropriateness with regards to interoperability, infrastructure constraints and the environment in which the technology will be implemented in.

Further research and analysis of these technologies and others will be required to establish the most appropriate solution for the point-of-care system to be used.

Table 20: Existing health technologies and solutions relevant to sub-purpose 2.

Projects and Initiatives	Region	Thematic Area	Partner
OpenSRP	N/A	MNCH	Various
OpenIZ	N/A	MNCH	MEDIC
Childcount+	East & West Africa	MNCH	Millennium Villages
Unumed	East Africa	MNCH, FP, Malaria, TB	Unumed
AmpathPlus	East Africa	MNCH, FP, Malaria, TB	Ampath
Comets	East Africa	MNCH, FP, Malaria, TB	North Star Alliance
BID eVaccination System	East Africa	MNCH	PATH
Mezzanine mVaccination system	East Africa	MNCH	Mezzanine
Novel-T Vaccination Tracking System	West Africa	MNCH	Novel-T

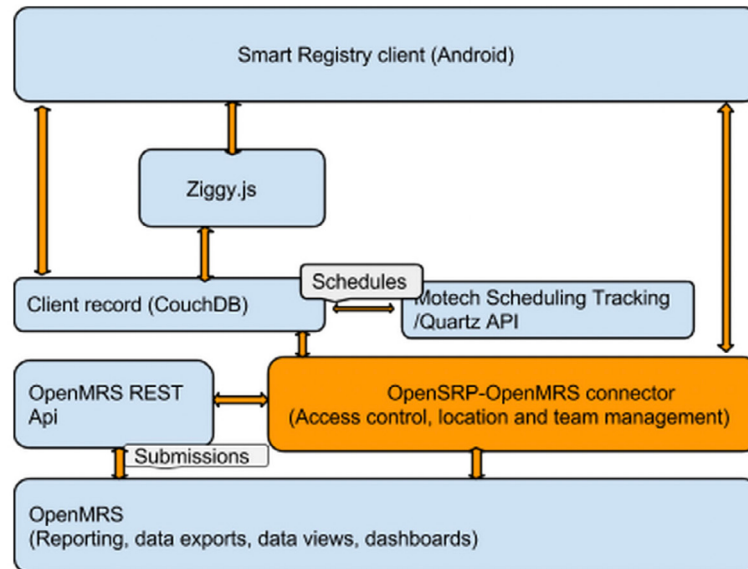
OpenSRP: OpenSRP is a software platform built on open-source technologies, designed for use by frontline health workers in low-resource areas focused on reproductive, maternal, new-born and child health (RMNCH). It aims to empower frontline health workers in their ability to register and collect information about patients more easily, efficiently and accurately, and to help generate reliable data for monitoring health outcomes and strengthening system accountability.

OpenSRP was formed out of a research project in India called Drishti, under a consortium of partners including John Hopkins University, mPower, Interactive Research and Development (Pakistan), Summit Institute (Indonesia), Harvard University School of Public Health, and Ona (Kenya). It is supported by WHO/UNICEF through the Technologies for Health Registers, Information, and Vital Events (THRIVE) Consortium, which is adapting, deploying and assessing the impact of OpenSRP through a five-year, multi-site research study.

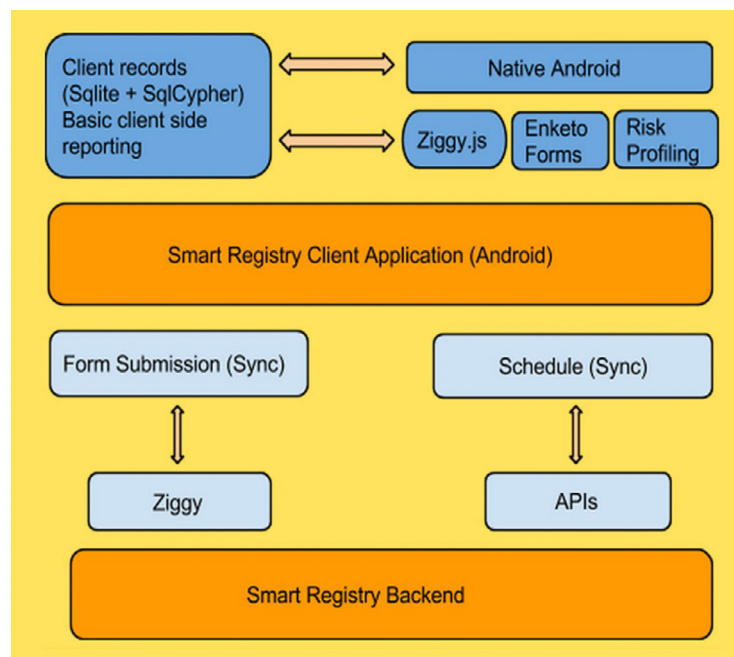
The OpenSRP system's core features are:

- Mobile data entry using android app designed for tablets
- Enketo webforms, with offline data entry
- Automated scheduling
- Decision support, patient alerts and flags
- Dynamic patient lookups (searching and filtering by various fields)
- Basic reporting in the app, with increasing support for export of patient and aggregated data to other systems
- Adaptable workflows
- Broad applicability and adaptability:
 - Designed for use across the reproductive, maternal, new-born and child health (RMNCH) continuum of care
 - Designed to be adaptable and expandable to other health settings

The OpenSRP codebase includes opensrp-client, an Android app designed for data entry on tablets, and opensrp-server, which forms part of the backend technology stack, both licensed under Apache License 2.0. The server-side technology stack is made up of multiple platforms, and is tightly integrated with OpenMRS, which acts as the back-end system for user and location management, access control, auditing, and reporting. OpenSRP-Server uses a couchDB database to store data collected from the client app, but this data is also stored in OpenMRS.



OpenSRP Server Technology Stack⁷



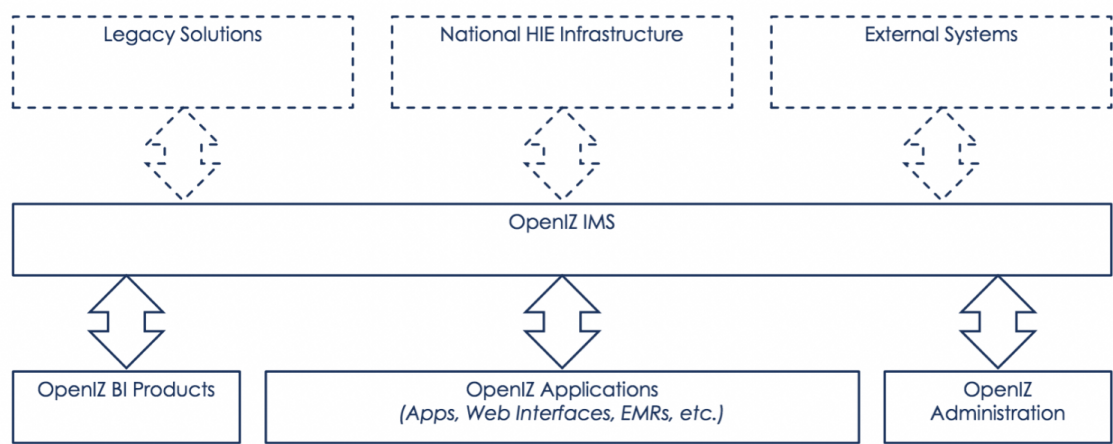
OpenSRP Client Technology Stack⁸

Additional features that are part of the long term aims of the OpenSRP community include:

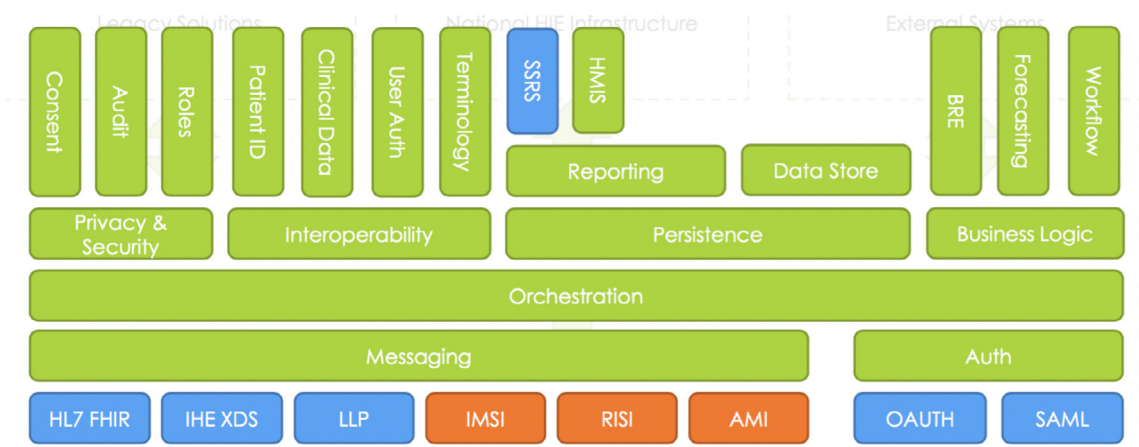
- Compliance with global protocols like OpenHIE and ICD-10
- Integration within national-level enterprise health information architectures
- Integration and interoperability with other widely adopted tools such as RapidPro, DHIS2, OpenMRS and Bahmni

There are a number of positives and challenges about using the OpenSRP software. Firstly, the system is adaptable and extensible. Secondly, the client application works well on Android and thirdly, the system has been successfully implemented in Zambia, Pakistan, Bangladesh and Indonesia, so there is evidence of use at scale in the field. However, there are several important challenges to note if OpenSRP was to be selected as a system for use in the RAD project. The most critical of these is that at present the technical documentation is either missing or not up to date. This makes picking up the code to adapt it for RAD challenging and time-consuming. Secondly the system uses an outdated (pre- 2.0) version of OpenMRS that does not support FHIR, with no clear roadmap on upgrading to a more recent version of OpenMRS. In fact, there is a general lack of a clear product roadmap for working with OpenSRP.

OpenIZ: Open Immunization (OpenIZ) is a community project that seeks to implement a generic platform for deploying immunization information systems, using an extensible, open architecture, that allows for the addition of features such as; materials management, analytics, authentication, outbreak management, internet of things, reporting & national data submissions, and more. Using a modular approach, it is envisioned that countries can select a package of features which work to achieve an appropriate solution for their environment. OpenIZ is developed and managed by the mHealth & eHealth Development and Innovation Centre (MEDIC) at Mohawk College in Hamilton, Canada, and the team has prior experience with HIE/OpenHIE architectures and components.



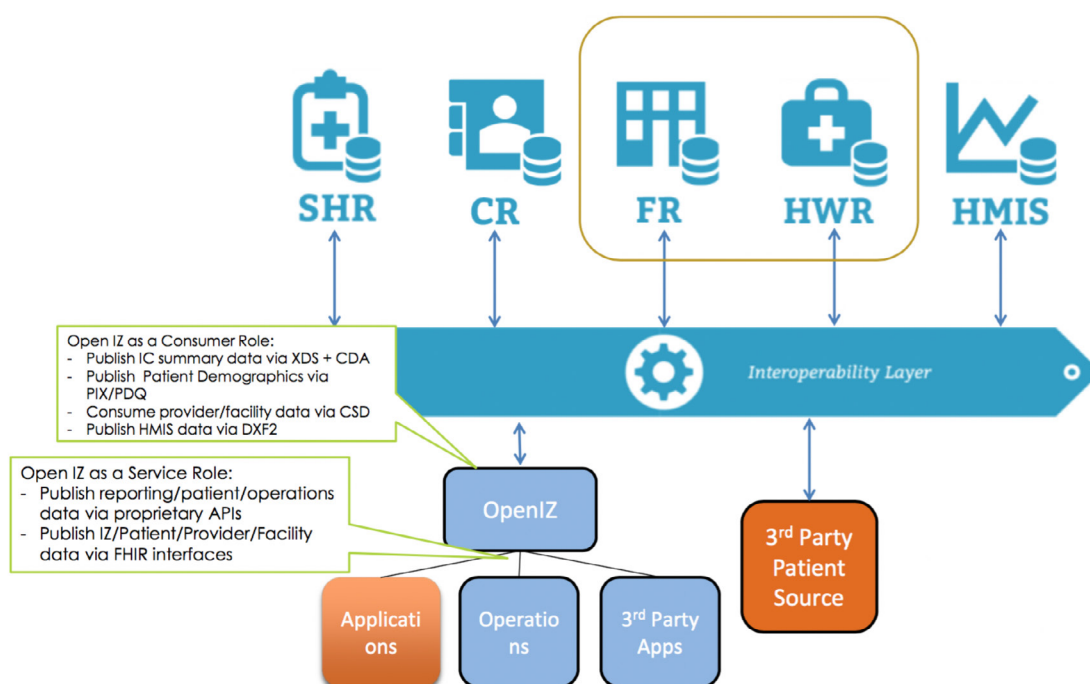
High-level OpenIZ Architecture⁹



OpenIZ IMS Architecture¹⁰

The Immunization Management System (IMS) is the core of OpenIZ, with components representing all services related to persistence, forecasting, reporting, integration, and security. The IMS has no user interface, but provides extension points and an API to manage communication with the core services. It is implemented as a services framework, with extension points business-rules based logic, data lifecycle workflows, and interoperability to other systems. The OpenIZ Disconnected Client provides a reference application for accessing the IMS in an offline way. All business rules and clinical protocols can be executed without an internet connection on Windows, Linux or Android client systems. The reference application can be switched out for other clients and tools. OpenIZ is designed to be used within an OpenHIE architecture, supporting both consumer and service capacities

National Infrastructure - OpenNIE



The OpenIZ system's core features are:

- A generic platform, designed to be extended and customized using baseline templates
- An open architecture, with extension points designed to allow new extensions and plugins to be added onto the core system.
- A flexible, customizable master data model.
- Disconnected Client provides a starting platform for accessing immunization systems functions in an offline way.
- Accounts for privacy and security policies

The OpenIZ codebase includes the following, with all repositories licensed under Apache License 2.0:

- openiz, the core headless service responsible for maintaining immunization state, reporting, and forecasting,
- openizdc, the disconnected mobile client reference application,
- openiz-admin, an administration portal, and
- openiz-dw, a data warehouse.

Additional features that are part of the long term aims of the OpenIZ community include:

- API service layer used for storing and retrieving immunization data, stock data, etc.
- Reference mobile application to query and store immunization data, with offline capabilities
- Web application supporting the following:
 - Operations interface for day-to-day use in the field, to monitor that immunizations were performed, perform stock operations, etc.
 - Administration interface for use by system administrators to set-up new types of immunizations, deploy forecasting logic, perform stock updates, etc.
 - Reporting interface to allow users of particular user groups to execute and download reports.
- Communication of patient information to a centralized patient identity registry using IHE PIX
- Communication of immunization information to a centralized document repository using IHE XDS And IHE PCC IC profiles (HL7 CDA)
- Communication of provider information using the IHE CSD profile.
- Communication of stock information to a centralized GS1 service using ASN.3 XML encoding of BMD1 message.
- There are a number of positives about OpenIZ. It is flexible and adaptable, community-driven and there is a clear roadmap for the ongoing development of the software. It also supports standards-based interfaces (FHIR, XDS, HL7v2) and is compliant with OpenHIE standards and data exchange protocols. However, the software is still in
 - Flexible and adaptable
 - Community-driven
 - Clear product roadmap
 - Pre-release stage, no existing implementations or evidence of use in the field

Childcount+: Childcount+ is a mHealth platform aimed at empowering communities to improve child survival and maternal health. It has full child immunization support, which groups all children in monthly age groups to know when a particular immunization is due. It records all immunizations and follow ups with all children who are behind with their immunization schedule and helps manage vaccination campaigns. Childcount+ is currently being used in Ethiopia, Kenya and Uganda, and is of relevance to the RAD project because it is a client-provider level solution, in the IGAD region, with a focus on MNCH.

Unumed: 5 is supporting health facilities at Kalobeyei refugee settlement (approx. 30,000 people) in Turkana County, through a solution that provides implementing partners an opportunity to register individuals with a unique biometric iris identifier. It is of relevance to the RAD projects because it is a client-provider level solution in IGAD region for mobile populations.

AMPATHPlus: AMPATHPlus is an integrated program that coordinates a comprehensive HIV and tuberculosis care and control program in western Kenya, which is implementing a facility based electronic medical record and information system that enables AMPATHPlus to register, identify, and follow up on patients. The counties in which AMPATHPlus is being implemented include Busia, Bungoma, Trans Nzoia, West Pokot, Elgeyo Marakwet, Uasin Gishu, Nandi and Kisumu. AMPATHPlus is of relevance to the RAD project because it is a project with a client-provider level solution that is being implemented in border counties within the IGAD region.

COMETS: COMETS is an electronic health passport system developed by North Star Alliance and ORTEC in response to a fragmented healthcare system unable to store and access the health information of mobile workers. It enables the exchange of patient-specific data between each Blue Box as well as the collection of site specific data used for monitoring and evaluation. COMETS is being used along the Malaba border between Kenya and Uganda. COMETS is of relevance to RAD because it is a cross-border, client-provider level solution, in the IGAD region.

BID eVaccination System: The electronic immunization registry, developed by the BID Initiative, automatically sends information to a tablet device, in terms of how many children are due for vaccines, which immunizations they need, and how much vaccine stock and supplies the clinic needs on hand. Children are entered into the registry at birth to ensure they do not miss a life-protecting vaccine. The BID eVaccination system is currently being implemented in Tanzania and Zambia, with plans to expand the initiative into additional countries in the future.

Mezzanine mVaccination system: The mVacciNation mobile application administrates vaccine delivery in the field by capturing vaccination records per individual child through a smartphone application at facility level, reporting on stock levels in the fridges to improve supply chain optimization, stimulating demand for vaccinations by educating mothers and sending direct reminders according to an official schedule via SMS and record fridge temperatures with exception reports to ensure the safe storage of vaccines. Mezzanine's mVaccination system is currently being implemented in Nigeria, Mozambique and Tanzania.

Novel-T Vaccination Tracking System: The objectives of the Novel-T Vaccination Tracking System are to: 1) Create and manage a geospatial database for all 8 high risk states in Northern Nigeria to support enhancements to the micro-planning process; 2) Support enhancements to Immunization Plus Days (IPD) processes by recording the vaccination team positions (the "tracks") at regular intervals; 3) Import tracks from the phones and calculate coverage analytics based on the intersects of the positions and the underlying geographic reference data for the settlements; and 4) Provide automated web based dashboard and maps at local and national level for use at the Nigeria EOCs in Abuja and Kano as well as remotely by external partners.

4.2.4. eHealth Profiles

Kenya

Within Kenya ICT programmes in the health sector are led by the Division of Monitoring and Evaluation, Health Research Development and Informatics (DivMEHRDI). The DivMEHRDI is supported by various local and international partners to fulfil different aspects of its mandate and is the custodian of several national level health information systems including the national Health Management Information System (HMIS), Human Resources for Health Information System (HRHIS), amongst many others. The implementation of these various systems is overseen by a number of Technical Working Groups anchored appropriately under the 4 units of the Division. The Health Informatics/eHealth Unit for example is functionally led by the National eHealth Steering Committee. This is undergoing changes and will transform into the Health Information and Research Interagency Coordinating Committee (HI-ICC) going forward. These existing government structures will guide the implementation of the RAD project in Kenya to ensure that the project follows national policies.

Table 21: Kenya Existing Digital Health Technologies Inventory

Centricity	Digital Health Solution Technology	Scope of Health Services Supported	Coverage	Partner/Vendor/Support Mechanism
Population	DHIS 2 adapted to KHMIS	All national (MOH) health indicators	National	USAID through the Health IT project at UoN
Population & Patient		HIV services	National	CDC through Palladium
Patient	KenyaEMR	HIV, TB, MCH	Select counties	CDC through Palladium and I-TECH
HIV, TB, MCH	IQ-CARE	HIV, TB, MCH	Select counties	CDC through Palladium
HIV, TB, MCH	AMRS	HIV, TB, MCH	Select counties	USAID through AMPATH

The following health facilities located at the Kenya – Uganda Border region within Busia county¹², are running the following digital health solutions;

1. Alupe (in border region) – KenyaEMR and ADT¹³
2. Lukoli (in border region) – KenyaEMR¹⁴
3. Sioport (in border region) – KenyaEMR and ADT
4. Busia County Referral Hospital – AMPATH Medical Records System (AMRS). They collect paper data forms and take to Eldoret for entry.
5. Nangina - KenyaEMR
6. Nambale - KenyaEMR
7. Lupida - KenyaEMR
8. Madende – KenyaEMR
9. Amkura2 - KenyaEMR

Uganda

eHealth in Uganda is governed at the national Ugandan Ministry of Health level through the eHealth Technical Working Group (eTWG).

The eTWG membership includes the following;

- Development partners (CDC, USAID, WHO, UNICEF, etc)
- Ministry of ICT
- National IT Authority of Uganda (NITA-U)
- National Medical Stores (NMS)
- Medicines and Health Service Delivery Monitoring Unit
- Representatives of Faith based medical bureaus
- Hospital Director from Hoima RRH
- District Health Officer from Luwero
- Technical Programs of MOH
- MOH Resource Centre

The eTWG is supported by the Division of Health Information who act as the eHealth secretariat at the Ministry of Health. The eTWG is indirectly supported by the National Identification and Registration Authority (NIRA), who provide national ID cards to citizens.

List of Select eHealth Projects:

1. Telemedicine – GOU through MOH and linked to India. It is yet to be fully utilized.
2. UgandaEMR – based on the OpenMRS platform, this EMR system is recognized by the MOH as the national EMR system. The priority use case is to support national HIV/AIDS, HTC, and SMC programming.
3. Human Resources for Health Information System (HRHIS)
4. Uganda's Electronic Health Information System powered by DHIS2
5. Knowledge Management Portal
6. MTrac for disease surveillance
7. Laboratory Management Information Systems supported by National Health Labs

4.2.5. Additional Findings from Site Visits

Illustrative Country Level Findings

Facility infrastructure

Results from site assessments at the Busia border region in Uganda suggest that there is a general lack of stable electricity at health facilities in the area. Most health facilities reported regular power outages and one of the five sites visited in Uganda was not wired for electricity at all. It was also observed that out of the 4 sites that were wired for electricity only 1 site had an alternate source of power (i.e. generator or solar panels). From all the sites visited only the Tororo General District Hospital had a fixed telephone line, all other sites made use of personal mobile phones. Good mobile penetration was noted, with a significant number of providers having access to “feature phones”.

Border crossings

Based on the discussions conducted with the health workers at the district and facility level there are numerous reasons for men and women crossing the Kenya/Uganda border, including trading and service availability or preference. While health workers reported providing care to non-citizens on the Uganda side of the border, they were also very clear that everyone was treated and from a national perspective, this wasn’t an issue at the health facilities. They also said that there is no formal way for them to know that the patient was a non-citizen however, health workers indicated that they were aware of non-citizens by their accents or unfamiliar home village addresses. Health workers were also clear that people didn’t disclose their nationality at the health facilities because they feared being put at the back of the queue or getting a lesser service.

In terms of referrals of patients between health centres, there is a formal referral process within Uganda but no formal referral process between Ugandan and Kenyan health facilities. However, health workers did mention giving informal referrals to health facilities on the other side of the border.

The current definition of cross-border population is also very broad and can be both people who physically cross borders for social, economic or security reasons as well as those who are born of parents who have at some stage crossed over a border for one reason or the other, even if the infant/child itself has not physically crossed a border within their lifetime. Cross-border zones are places of social, cultural and economic exchanges between countries where the populations between these borders share numerous social and family links. These borders are often perceived as artificial concepts and as such do not prevent either exchanges between populations, or cross-border movements. In other words, the current definition of cross-border movements can be both physical involving actual physical migration across geographical boundaries and conceptual where the parents and/or caregivers had once migrated across borders carrying with them their social, cultural and economic traits; some of these traits will impact on their children.

is undergoing changes and will transform into the Health Information and Research Interagency Coordinating Committee (HI-ICC) going forward. These existing government structures will guide the implementation of the RAD project in Kenya to ensure that the project follows national policies.

Patient identification

It was clear that with free access to primary health care services to all in Uganda the nationality of patients did not matter to the health workers or health service managers. However, patients were asked for whatever identification documents they had on them. They were not penalised for not being able to present identification documentation during health facility visits.

The interviews clearly illustrated that there is a general issue of identifying patients in relation to repeat/return visits of local patients and the tracking thereof between facilities as well as the mobile cross-border population. This is related to poor record keeping at health facilities in general. In the one health facility visited the respondents indicated that there are patient folders, but their actual use is unclear as they were described as a “wall of boxes with files” which are patient files that are never used. The responses to questions indicated that at the health facilities that were assessed patient level forms or folders are usually developed by implementing partners (NGOs) for example the PLAN MyChild Booklet. In many cases medical records take the form of a blank patient book mainly in form of a notebook that patients bring with them for their visits and also retain them after being used by health workers to write their clinical notes. In instances such as immunization where registers or booklets are used and issued with patient identification numbers, these numbers are often serial and prepared using the person’s place in the queue and on the day that they are seen and merely used as a reference in a register to identify the last immunization captured. The exception here is the MyChild booklet (PLAN) and a standard A5 book that is used to track patient records. The MyChild booklet has a pre-printed identification number which is entered into the register and which the mothers are supposed to keep for ongoing child identification purposes.

In terms of person identification on the Ugandan side of the border, children born in a facility in Uganda or who come in for the first time are given a manual number as a birth record. This document is used for birth registration, the patient book or MyChild booklet in pilot districts as well as the Child Health Card in non-pilot districts.

NIRA (National Identification Registration Authority) has partnered with the Ministry of Education in an attempt to enroll students including foreigners in schools in the national ID program. This however, excludes those that are not in school who do not have a national ID. Uganda is currently trying to enforce the requirement for national ID registration by making it mandatory for any cell phone number to be associated with a national ID number. This has increased the number of individuals registering for a national ID and should help drive forward the process of civil registration in the country.

Data Collection

The current system of data collection is paper based at the public facilities. Respondents said that the current data collection tools do not necessarily reflect current data needs. Data collection at the non-profit facility is electronic but is not integrated with the national system. Public sector interviewees stated that current practices respect patient privacy, with data sharing only done in the case of patient referral. However, they cautioned that paper-based records are less secure than electronic formats.

Digital Health

Interviewees said that an EHR would be helpful for collecting patient data, including an electronic immunization register. They would like to see better and more secure information sharing and integrated systems to enable improved continuity of care. They also cited a need for more accurate data. Both public and non-profit facilities stated that the country of origin of clients would be helpful information to improve accuracy of coverage and to identify who is receiving services. Non-profit staff expressed a desire for more information sharing between government and non-government facilities, especially related to surveillance reports.

Immunization

Immunization is thought of as highly demanded service in the cross-border region visited. Challenges to achieving full immunization cited by respondents included inaccurate coverage data, difficulties in data capture and transmission due to paper-based immunization registers, and lack of data from non-governmental facilities. Respondents indicated that it would be helpful for them to have access to information from neighbouring countries related to immunization policies and guidelines, immunization and coverage rates, and disease outbreaks.

Immunisation records

The use of paper-based systems is currently in place for immunization and MNCH reporting in Uganda. Paper-based systems typically comprise three sets of documents, namely facility health registers, tally sheets and patient held records (self-purchased A5 books or MyChild booklets). Tally Sheets are forms used by VHT's (Village Healthcare Teams) or Vaccinators to record the amount of vaccines dispensed (i.e. aggregate data) when they go out to the community to perform outreach programs. These different paper records have different functions; the registers are used at the clinic to capture patient data and the tally sheets are used during mobile immunisation campaign sessions in the community to capture data. More research has to be done to understand the differences between the data collected on the different paper records. The specifics of the data captured in the registers and tally sheets still needs to be reviewed and analysed. The nature and completeness of the data captured in the registers, tally sheets and patient held records is also an unknown at the point of drafting this report. The comprehensiveness of the paper immunisation records is important as it can be used as an indication of the value that the health workers put on patient records and the continuity of care.

An example of a commonly used immunisation record platform is MyChild. It is a system designed to address issues in preventive child health services in low resource settings. The system has two interfaces depending on the resource settings:

- MyChild App – which is a software application used in environments with electricity, reliable network access and security, this however was not observed in the sites in Uganda.
- MyChild Card – which is a paper-based method used in environments with no electricity, reliable network access and security, was observed in some sites in Uganda.

Currently this system is being piloted in 4 districts (i.e. 387 health service delivery points) in Uganda with over 116 000 children registered and over 30 000 children fully immunised. The 4 districts are: Tororo, Wakiso, Mukono and Dokolo.

Supply chain management

The rapid assessment team discovered that orders for vaccines are usually forecasted using population estimates which does not include people that cross the border. This could account for the reported shortages of vaccines, although this was reported to happen very rarely. Several of those interviewed mentioned that medication shortfalls might be the result of cross-border service users, where the tracking of patient information is not always in place.

Health workforce

Observation at the facilities noted that there was a shortage of health workers everywhere except at the "container drop centre" which focused on HIV testing, counselling and treatment. The centre was not very busy at the time the team visited. The busiest facilities visited was the Level II Health Centre and District Hospital. The team noted that in practice the level of the health facility is not always indicative of the workload, type or amount. The interviewees at the health facilities identified numerous health workers roles and responsibilities (Registered Nurse, Assistant Nurse, Health Assistant, Vaccinator etc). Unfortunately, the rapid assessment team didn't have the opportunity to interview health workers from each group. More research needs to be done into understanding the role of each level of health worker in delivering and recording immunization services at a health facility and outreach campaign level.

HealthCare Financing and Universal Health Coverage

Access to health services without exposing users to financial hardships remain key to reaching Universal Health Coverage targets. The site assessment findings show that not all people had access to health services they need including immunization services.

Key challenges identified in terms of health care financing were:

- Lack of resources for immunization outreaches
- Tracking of financial resources as a basis to understand costs and budgeting
- Lack of coordination and duplication of donor-funded projects

Data use

In terms of the routine data collection processes that are used in facilities that were visited, paper-based aggregate data reports are created using data from the paper-based registers and are sent from the facility to the district health department where they are captured in electronic format and uploaded into the national DHIS2 system. Issues with timeliness of routine reports were noted due to long delays in getting paper reports to the district level.

In addition to the paper to DHIS2 system, all health facilities are required to report weekly via an SMS through the mobile phone system known as mTrac, however, only for a specified list of notifiable diseases. In both the case of mTrac and DHIS2, the flow of data is upward from health facility to district and national level only. Users at the district level carry out data analysis for their district but there was not much evidence of downward feedback of reports from national to district or from district to facility level.

Gender

One issue that came up in the landscape analysis but wasn't raised or interrogated during the rapid assessment was the issue of gender and access to health services and technology. The literature highlighted that many women have difficulty accessing health services due to barriers like; time off work, money for transport etc. It was observed at the health facilities that the majority of clients were women, often with children, particularly at the lower level community facilities. The literature also indicated that mobile phone ownership amongst women is an issue in many places in Africa, as men as the heads of households tend to have ownership of the family phone. While this hypothesis was not tested during the field visits the team did observe women in the waiting areas of the health facilities using mobile phones - both smart phones as well as feature phones.

5. Conclusion

The information contained within this landscape analysis report represents the body of evidence that was collected throughout year one of the project, which is key to identifying and validating the user needs for both WAHO and IGAD, as well as helping the RAD project propose and develop solutions that will meet these users need in terms of the two sub-purposes, and thus achieving the overall goal of the RAD project.

It is noted that while the landscape analysis was a specific year one activity, it will continue throughout the life of the project to ensure that the RAD project continues to identify critical gaps, learn from existing projects and initiatives, and ultimately, ensure that the implementation of the RAD project is both useful to stakeholders, as well as complementary to existing initiatives in the health data space. The decisions that were based on the landscape analysis have been included in the Year One Annual Report.

For sub-purpose 1 the overarching need for both WAHO and IGAD was the aggregation and utility of data at the regional level to generate evidence for decision making. To help meet these user needs, it was pertinent to explore the policies, guidelines, information products and projects/initiatives that exist within the two regions that would be relevant to fulfilling the sub-purpose and achieving the goal of the RAD project. Findings suggest that all countries in the WAHO and IGAD regions produce information products, and that the type, frequency, analytics, visualizations, coverage and dissemination, vary across the regions and the countries therein. Several existing projects, initiatives and subsequent organizations exist that are of relevance to sub-purpose 1 and the overall goal of the RAD project. A review of the existing policies, both at the regional and national levels, suggests that the role of WAHO will be key in guiding cross-border data sharing, as well as policies related to disease surveillance, migration and eHealth, through agreements and inter-regional collaboration initiatives, as well as fostering partnerships, setting and defining actionable targets, and mobilizing resources for regional needs. The RAD project will also consider the national level policies relating to cross-border data sharing, disease surveillance, migration and eHealth. Thus, the above considerations from the landscape analysis would be useful in fulfilment of the sub-purpose 1, by equipping and empowering key stakeholders to make data-based healthcare delivery decisions, through aligned and harmonized data collection systems that will be used by regional and national partners for evidence-based decision-making.

For sub-purpose 2 the need identified by WAHO was service availability mapping at health facility level within border regions to support outbreak management, while for IGAD, the need identified was a client-provider level solution at cross-border facilities to improve continuity of care across international borders for cross-border mobile populations, including pastoralists. The initial focus of the proposed IGAD solution will be immunization and MNCH. To help meet these user needs, it was pertinent to explore the policies and guidelines relating to migration; the identification of clients; cross-border data sharing; disease surveillance and eHealth. The need identified by WAHO would not be a priority for the year 2 of the project and would be considered later during the project implementation. For IGAD's need, it was key to understand the context for defining migration and the identification of cross-border populations, as this would inform the development of the client-provider level solution. The initial site for the client-provider level solution would be the Malaba border between Kenya and Uganda. During the landscape analysis, several existing solutions, projects, initiatives and subsequent organizations were identified that are of relevance to sub-purpose 2 and the overall goal of the RAD project. These solutions, projects and initiatives are of relevance due to their thematic coverage of MNCH and Immunization; their geographic, in terms of cross-border regions; as well as their utility of a digital health solution for data collection. The existing solutions, projects and initiatives identified would provide opportunities for interventions by the RAD project to learn from and leverage. Thus, the above

considerations from the landscape analysis would be useful in fulfilment of the sub-purpose 2, by focusing at the client-provider level, to improve health outcomes for targeted individuals utilizing an electronic health information system based on individual data in the selected geographic areas.

Overall, the results of the landscape analysis will be useful in defining the use cases (user needs and their context). The use cases will be key in developing the proposed solutions for WAHO and IGAD both at the cross-border areas and the regional levels thus driving the development of the year 2 work plan and implementation of the RAD project in the subsequent years. The planned solution will have components, that are extensible allowing for additional data capture and system utility components. The solution will be developed to be integrable with the existing national systems.

6. Next Steps

Given the intent of the landscape analysis to inform project implementation in current and subsequent years, decision point meetings on both the ECOWAS and IGAD sides are planned. The findings from the landscape analysis activities as pertains to both sub-purpose 1 and sub-purpose 2, will inform the discussions during the decision point meetings. The meetings are to discuss the findings from the landscape analysis activities, and thus inform the priority setting for the two sub-regions in terms of project implementation.

From the priorities set in each of the sub-regions (IGAD and ECOWAS) during the respective decision point meeting, work plans for the subsequent project years will be discussed, outlined and developed; these work plans will set the RAD project implementation priorities for the subsequent years. Thus the findings from the landscape analysis, through the stakeholder engagements and key informant interviews will feed the work plan result areas, milestone and activities; through the deliberations from the respective sub-region decision point meetings.

Finally, to visualize and curate the findings from landscape analysis in an electronic data platform, the “Digital Health Projects Map” will be developed. The Digital Health Projects which represents an online version of all findings from the Year 1 landscape analysis, in terms of digital health projects and initiatives that are being implemented across Sub-Saharan Africa and of relevance to the RAD project will be developed. This map will be a “live” platform with continual updating as additional information is accessed regarding digital health projects and initiatives relevant to the RAD project.

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