

AoS Health Initiative: Antimicrobial Resistance

A Platform Approach for AMR Surveillance

Harnessing Expertise for the Global Good

The emerging threat of antimicrobial resistance (AMR) necessitates a coordinated response from the global community. The Review on AMR (amr-review.org) estimates that if left unaddressed, resistant pathogens could account for up to 10 million deaths annually and USD 100 trillion in global GDP loss by 2050. Through the UN Tripartite Alliance for One Health, and initiatives such as the UK Government's Fleming Fund and Global AMR Innovation Fund (GAMRIF), the stage has been set for multi-sectoral and cross-cutting collaboration to address this need. Partners of the AoS Health Initiative have been working alongside the Foundation for Innovative New Diagnostics (FIND), Fleming Fund, Global Fund and others to develop an AMR Surveillance Platform to strengthen countries' ability to capture and utilise high-quality AMR data.

The AoS Health Initiative is a partnership led by Blue Frontier (UK), the eSHIFT Partner Network (Switzerland) and the Software for Health Foundation (UK). The Initiative combines the expertise, know-how and technical resources of public, private and government organisations to provide comprehensive, well-engineered, open source digital health systems to LMIC environments. Our goal is to empower national health systems leaders and healthcare providers to build resilient, best-in-class data management systems efficiently and sustainably, thereby enabling the development of data-led programmes and improving health outcomes.

For AMR, the AoS Health Initiative is working to continuously enhance our surveillance platform to improve national understanding of AMR trends, strengthen One Health data management and analytics, and act as a catalyst to accelerate progress in countries.

The Platform Approach to Disease Surveillance: Efficient, Resilient and Sustainable

Robust AMR surveillance requires more effective data capture, interoperability between disparate systems, and an increased capacity for rapid analysis of health trends. Achieving this objective in our current digital and information-rich era requires systematised integration across data sources in a manner never yet seen in the health sector.

The AoS Health Platform consists of hardware infrastructure (cloud or dedicated), software, configuration, customisation and localisation of digital health equipment, telecommunications infrastructure and software tools. These combine to provide sustainable reference implementations of complete systems architectures to address one or more public health needs. All platform elements come together in a ready-to-use hardware, thereby abstracting the technological complexities and empowering national health system leaders and healthcare providers to build best-in-class data management systems quickly.

The AoS Health Platform aims to create efficiency and robustness within all digital health implementations and remove the growing pains (and costs) from both early-stage and seasoned digital health implementations, allowing our country partners to jump-start their digital health infrastructure capabilities. Furthermore, through cross-sectoral collaboration, engagement with public- and private-sector entities, and strong country involvement, we continually enhance the platform to ensure its sustainability and flexibility to address surveillance needs. As a result, every country can benefit from the ongoing developments of the AoS Health Platform, cost-effectively accelerating innovation to inform better policy decisions.

THE STORY BEHIND THE AOS HEALTH INITIATIVE

Born as a program to address a surveillance gap in a particular context, the resulting AoS Health Initiative and Platform have led to a robust, mature data warehousing solution that is affordable and scalable in LMICs. We envision a future where AMR surveillance is possible across all impacted sectors in all LMICs

NOVEMBER

- GAMRIF funds AMR Surveillance pilot in Zambia and Senegal
- Development begins

FEBRUARY

- Zambia and Senegal projects complete
- AoS Health AMR Surveillance tools released as a global good
- Launch of the AoS Health Initiative

SEPTEMBER

- Fleming Fund Nepal and Kenya Projects begin

MARCH

- Launch of AoS Health AMR Surveillance in Nepal and Kenya
- ONGOING**
- Support of Nepal and Kenya projects
- Enhancement of Platform features
- Advocacy and planning for next steps

2018

2020

2021

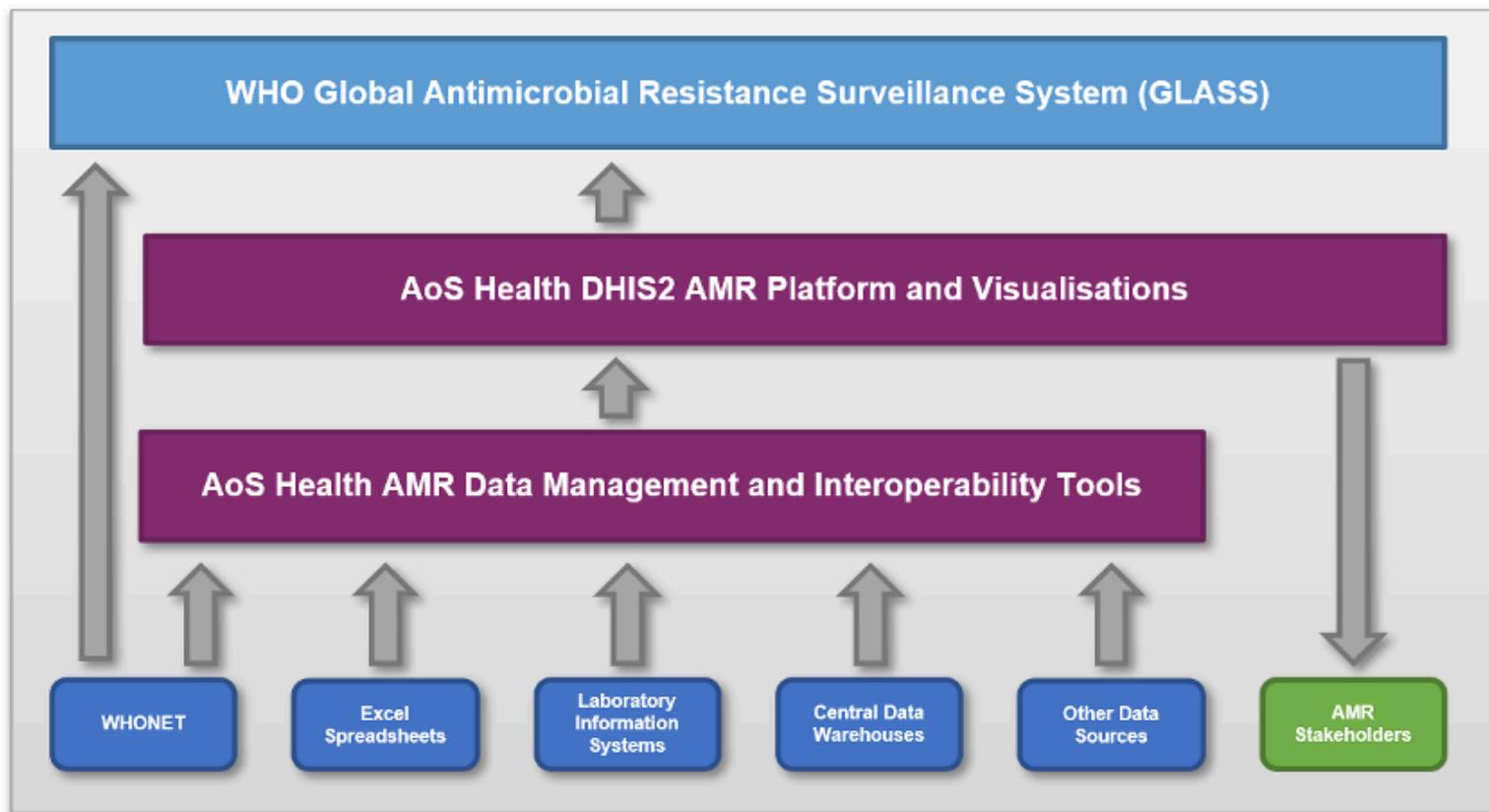
2022



Increasing Platform Maturity

The AoS Health AMR Surveillance Platform

Data, Information and Flow Diagram



AMR Software Suite

SOFTWARE/TOOLS	FUNCTIONALITY
DHIS2 AMR PLATFORM	A customised DHIS2 metadata package that serves as the data warehouse for One Health AMR data. The system includes a standard set of indicators and dashboards to visualise AMR trends and can be customised to meet surveillance needs.
OPEN INTEROP	Open Interop is an open-source interoperability tool that is fully customisable to meet data management and data transmission needs. It enables data collection, translation and forwarding to connected endpoints.
ODC	A desktop-based data loading tool that sends data from spreadsheets or WHONET files to Open Interop for transmission to DHIS2.
ODX	An automated data cleaning tool for AMR data that can be configured to automatically fix common spelling errors and variations in laboratory information system (LIS) spreadsheet extracts. Enables data managers to rapidly assess data quality and reduce data cleaning workloads.
GLASS REPORTING MODULE	An open-source tool that automatically creates both RIS and Sample file GLASS reports from the DHIS2 data warehouse.
SUPPORTING TOOLS	The AoS Health AMR Platform also includes several supporting software tools, providing services such as document management, project management and support, and server infrastructure monitoring. The flexibility of the platform approach enables additional customisation for implementation-specific needs.

Platform Functionalities and Approaches

FUNCTIONALITY AND APPROACHES	BENEFITS
NATIONAL AMR SURVEILLANCE	A central system for national AMR surveillance that enables collection of antimicrobial susceptibility test (AST) results and the tracking of resistance trends and patterns. The Platform has been designed to enable rapid deployment and catalyse national-level AMR surveillance with minimal investment and short implementation time requirements.
ONE HEALTH	The Platform has been configured for surveillance of AMR in humans, animals, the environment, feed, and food. This enables analysis of resistance trends across sectors, better understanding of the impact of the food and agriculture sectors in increasing resistance trends, and the development of evidence-based interventions to reduce antimicrobial overuse.
GLOBAL REPORTING	The Platform enables automatic generation of both Sample and RIS reports through the GLASS reporting module.
DATA ANALYSIS AND VISUALISATION	The DHIS2 system includes standard dashboards and visualisations for AMR. Users can also utilise the DHIS2 Event Reports and Data Visualiser to create and share their own dashboards. The data within the DHIS2 system can also be made available for use with more robust analytics tools, such as R Studio.
LABORATORY AND INFORMATION SYSTEM INTEGRATION	Open Interop, the interoperability tool included in the platform, enables integration with existing systems through its API. Data can be pulled directly from laboratory information systems (LIS), central data warehouses, WHONET, or can be uploaded in a spreadsheet format.
FLEXIBILITY AND CUSTOMISATION	The standard data model can be expanded and customised to meet local surveillance needs. It can also be expanded to include other data such as antimicrobial usage (AMU) and import/export data.
IMPLEMENTATION BEST PRACTICES	Members of the AoS Health Initiative have decades of experience working in LMIC settings. This on-the-ground knowledge of best practices for the implementation of health information systems in resource constrained settings informs the AoS Health Implementation Framework.
LOCAL SERVER INFRASTRUCTURE	The Platform includes server infrastructure that can be deployed locally. Infrastructure has been designed to be cost-effective, using off the shelf components, with the intension of maximising utility and minimising cost, and enabling standard approaches to support.
TRAINING AND CAPACITY BUILDING	AoS Health is committed to capacity building and knowledge handover to ensure sustainability of implemented systems and has created training curriculums for platform components to promote operational self-sufficiency.
COMPREHENSIVE DOCUMENTATION	User documentation has been created for the AMR Surveillance platform tools and configurations, and all documentation has been made available online for beneficiaries. The selected software tools also have official documentation that can be used for further configuration, customisation, and troubleshooting.
SUSTAINABLE IMPLEMENTATIONS	The AoS Health Initiative is focused on building sustainable systems. Through cross-sectoral collaboration, engagement with public- and private-sector entities, and strong country involvement, we continually enhance the platform to ensure its sustainability and flexibility to address surveillance needs. Every country can benefit from the ongoing developments of the AoS Health Platform, cost-effectively accelerating innovation to inform better policy decisions.
GLOBAL GOODS	The AoS Health Platform consists of open-source or free to use under license software. The Platform is being developed using an action-research approach with the end goal of establishing the platform tools and methodology as global goods and as reference architecture for digital health deployments. Members of the AoS Health Initiative are committed to contributing our innovations to the global digital health community and adhering to the Principles of Donor Alignment for Digital Health.

THE WAY FORWARD

As we work towards scaling and improving the AoS Health Platform for AMR, we have identified a list of essential elements that are part of our strategy to scale successfully:

- **Sustain** and **strengthen** existing AoS Health AMR country implementations
- **Expand** the platform to other countries and build an AoS Health AMR community of practice that establishes a mechanism for stakeholders to benefit from ongoing enhancements and improvements made in other implementations
- **Improve** AMR data visualisations and dashboards, data use, and information dissemination to local and national stakeholders
- **Establish** robust support mechanisms to ensure implementation sustainability and a path to self-sufficiency for beneficiary countries
- **Expand** the suite of supported software and open-source tools that are included in the platform, and explore engagement and integration with other AMR tools
- **Expand** collaboration with public- and private-sector stakeholders, and raise funds to implement these next steps
- **Contribute** our learnings back to the AMR community through published research

Founding Partners

The AoS Health Initiative was established by Blue Frontier, the eSHIFT Partner Network, and the Software for Health Foundation in 2020. Our team combines the experience, know-how and technical resources of our partners in order to provide comprehensive and open source digital health services. We share a collective desire to improve the delivery, quality, and sustainability of digital health systems in LMIC environments and collaborate with multiple public, private and government organisations to achieve this vision.

bluefrontier

Based in Salisbury, Wiltshire, Blue Frontier offer a full range of technical, web, software and digital marketing services for business. Blue Frontier are proud to be a part of the AoS initiative and to contribute our experience and skills, especially in connecting diagnostic instruments and developing health data management systems for world leading device manufacturers. We are committed to using our expertise in innovation and our ISO standard software development capabilities to strengthen the AoS open-source tool kit and help innovate new digital tools within the AoS reference architecture.

eSHIFT PARTNER NETWORK

The eSHIFT Partner Network is a Swiss not-for-profit leader in digital health architecture and information systems implementation founded in 2012. eSHIFT is proud to contribute our public health knowledge, health information system and management expertise, and on-the-ground implementation experience to the AoS Health Initiative. We believe our country partners can achieve sustainable and resilient health systems by leveraging ongoing digital health innovation for better health outcomes. The AoS Health Initiative brings us one step closer to achieving this vision.

The Software for Health Foundation

Software for Health Foundation is proud to support the AoS initiative through managing a portfolio of open-source, cloud based and 'free to use under licence' applications, tools and services, optimised for use in LMIC's. Our aim is to drive adoption of these digital tools and to advocate for global public goods that conform to the AoS reference architecture. We are committed to creating meaningful and sustainable services and to share knowledge with our benefactors as part of guiding them on a path to self-sufficiency.

Partners

We have been fortunate to collaborate with these organisations on the development of the AoS Health AMR Surveillance Platform.



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