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PREVENT DETECT RESPOND

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The Critical Role of Laboratories in the Global Health Security Agenda

Galvanised by the Ebola outbreak in West Africa, the international community has recognised the urgent need to improve global capacity to prevent, detect and respond to biological threats. To this end, the Global Health Security Agenda (GHSA) "is an effort by nations, international organisations, and civil society to accelerate progress toward a world safe and secure from infectious disease threats".[1] To achieve these aims, the GHSA focuses on promoting progress towards the full implementation of heath security frameworks using a One Health approach.

To facilitate this progress, the GHSA is divided into 11 separate, but cross-cutting and interconnected Action Packages, each with specific targets to prevent, detect and respond to emerging biological threats, as outlined below.

The One Health Initiative recognises the importance of an integrative effort to attain optimal health for humans, animals and the environment, and draws on the expertise and collaboration of all medical, veterinary, and environmental disciplines.

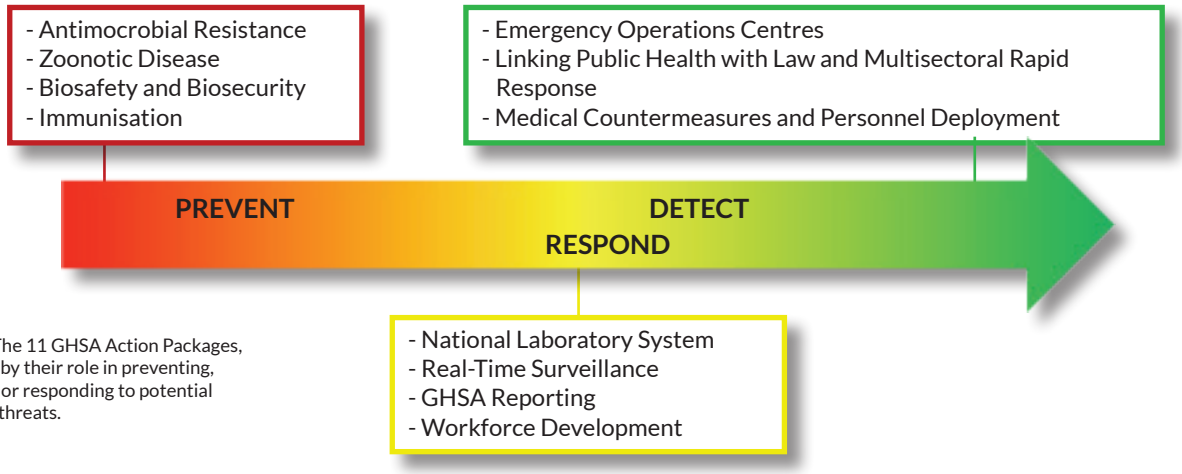

Figure 1. The 11 GHSA Action Packages, organised by their role in preventing, detecting, or responding to potential biological threats.

The laboratory, a cornerstone of the health system, underpins the GHSA strategies. The laboratory plays an essential role in prevention that includes understanding the extent of diseases of public health importance, assuring the safety and security of dangerous pathogens, and monitoring the effectiveness of immunisation programmes. Timely detection of disease threats can only be achieved through robust real-time surveillance and reporting systems operated by a trained and interconnected workforce. Connectivity must extend beyond the laboratory network linking public health, law enforcement and other pertinent sectors to ensure a coordinated response.

During the last decade, tremendous progress has been made in strengthening national laboratory systems; however, significant gaps still remain. The recent Ebola outbreak revealed institutional and diagnostic gaps that restricted emergency response capacity. The challenges of delivering diagnostics services where they are most needed, building a biosafety and biosecurity workforce, and strengthening laboratory networks and regional collaboration must be addressed through global frameworks that support the development of national policies and implementation plans that guide all stakeholders on meeting the GHSA goals. With significant investment, the aims of the GHSA can and will be realised.

By: Rosalie Whedbee, MPH (Editorial Team), Paula Fernandes, MBA PhD (Editorial Team); Editors: Rachel Crane (Editorial Team), Michele Merkel, MS (Editorial Team), Corey White, MPA (ASLM)

Reconstructing Laboratory Systems: How to Rebuild in Ebola-Affected Countries

As the world's most devastating Ebola epidemic draws to a close, governments and local institutions are looking to the future. Emerging from the urgent task of crisis management, experts are asking what steps can be taken to rebuild badly shaken health infrastructures. In the words of Liberian president Ellen Johnson-Sirleaf, the tasks are now to "stamp out the last embers of this epidemic, transition toward restoration of health services and rebuild our health system in a resilient manner."[2]

The Ebola epidemic exposed, and was fuelled by, a number of weaknesses in the health systems of affected countries. In many cases, governments were already aware of these issues and planning solutions. In the aftermath of the epidemic, the time to address these problems is now. Medical and diagnostic laboratories play a central role in an emerging vision of rebuilding resilient health systems in Guinea, Liberia and Sierra Leone.

"Laboratory science is crucial to any disease outbreak. It feeds into every part of containment, coordination and control. The recognition of the importance of the laboratory to this crisis was critical in Liberia's success."
-Candace Eastman, CEO, Africabio Enterprises, Inc.

National leadership has been at the forefront of efforts to rebuild; the governments of Guinea, Liberia and Sierra Leone made public their plans for recovery at the International Ebola Recovery Conference in July of 2015.

Management and surveillance

The long delay between the emergence of cases of Ebola virus disease and the start of national containment efforts reflected a shortage of diagnostic laboratories and a lack of surveillance and reporting structures at the national and regional levels. The lack of any surveillance system, either local or integrated between countries, contributed to the escalation of what initially seemed to be a containable outbreak.[3] Intensive investment in laboratory testing, contact tracing and screening was crucial for establishing control over the epidemic.

In its wake, establishing a sustainable programme of integrated disease surveillance and response (IDSR) is a priority for the prevention of Ebola re-emergence. IDSR is a flexible system that can be used to monitor and control the spread of other infectious diseases prone to outbreak. As national officials and international partners build IDSR systems, they are also prioritising international communication about emerging threats and coordinated responses.

The need for more flexible, multi-pathogen approaches to infectious disease surveillance is a theme that has emerged from reflections on how best to rebuild. Earlier efforts at health development focused on individual diseases one at a time. While working towards the UN's Millennium Development Goals, which focus on control of HIV/AIDS, malaria and tuberculosis, international partners had developed numerous parallel structures for disease-specific diagnosis and treatment. Unfortunately, the multitude of initiatives may have undermined more broadly-focused national institutions that could have helped coordinate local and national resources for a more comprehensive response.[4,5] Recovery efforts in collaboration with international partners are being framed in order to support, rather than undermine, district level health systems with national ownership. For example, Sierra Leone's Ministry of Health and Sanitation has rolled out a health sector Service Level Agreement for all partnerships moving forward, to coordinate and monitor the activity of many partners within the Ministry of Health and Sanitation. Likewise, the Liberian redevelopment plan notes that being able to manage contractors is a useful skill learned in the course of the outbreak.[6]

"Establishing a sustainable programme of integrated disease surveillance and response (IDSR) is a priority for the prevention of Ebola re-emergence"

In the transition from outbreak response to outbreak recovery, there will need to be an emphasis on improving the standards in peripheral laboratories in addition to regional facilities. Candace Eastman, CEO of Africabio Enterprises, Inc. (AEI Global) in Liberia, notes that specific issues that will need to be addressed include accessibility, facility requirements to meet operational standards, inventory management, training, guidelines for consistency between laboratories, and a robust referral system. Robust national systems with wider capabilities will be better able to weather the shock of unexpected emerging infectious diseases in the future. *(Cont'd on page 5)*

(Con't from page 4)

Supplies and Infrastructure

When the outbreak began, already-stretched laboratories faced even greater challenges. When adequate personal protective equipment (PPE) and reagents were needed most, the fragility of the supply chain became apparent. The danger of laboratory infection was tragically realised at the Kenema Government Hospital's Lassa Fever research laboratory, which was shut down in August 2014.[7]

As implementing partners conclude their clinical and diagnostic work, the equipment and supplies they have provided and facilities they have helped to build have the potential to become assets in a new, stronger health system.[8] A first step, notes Dr. Amadou Sall of the Institut Pasteur in Dakar, will be to determine what equipment exists and where it can be used most appropriately. "Making sure new things are working and being used properly is a line of action people need to be working on," says Dr. Sall, adding that maintenance for these assets will be key to building them into a sustainable national laboratory system.

"There will need to be an emphasis on improving the standards in peripheral laboratories in addition to regional facilities"

Biosafety concerns will also play a key role in strengthening laboratory infrastructure and supply chain. During the outbreak, the system showed gaps in biosafety training, pathways and procedures for collection and transport of post mortem samples, and a lack of PPEs and other biosafety measures in the laboratory. Ms. Eastman also acknowledges the importance of including private laboratories in biosafety strengthening efforts, stating that, "the private sector must be included in programmes to improve biosafety in order to ensure a continued public health response owned by all."

Funding

Efforts to rebuild and strengthen laboratory systems will have considerable expense. Ms. Eastman knows that governments will not be able to be responsible for the necessary financial investments alone. "We need to start to think creatively," she states. She mentions public-private partnerships as a possible solution. These partnerships will be inclusive of all entities that have the expertise to bring about change, and can provide measurable results. All collaborative efforts, however, will be guided by local legislation and policy to ensure an environment of quality and standards in the delivery of healthcare services both publicly and privately.

Human Resources

To build a robust system with broad capabilities, a talented and well-trained workforce is key. Before the outbreak began, health systems in each of the three countries had been compromised by long periods of civic unrest, which had taken a toll on human resources and health funding. Of a cadre of intermittently paid health system personnel, most were clinical, with few laboratory or public health workers, and no formal public health training programmes available.[9]

Concentration of health administration at the central level, with limited district or provincial level oversight, had led to inefficiencies in hiring and payment, along with slow communication between central authorities and local laboratories. Decentralising health administration is a priority for both more responsive surveillance systems and better human resources management. During the epidemic, the United Nations Development Programme (UNDP) coordinated salary payments for the doctors, nurses and laboratory staff in the path of the disease.[10] As the crisis wanes and each country re-establishes its own health system, building a sustainable payment system is a priority.

In Guinea, efforts are also underway to harmonise salaries between the national health system and other organisations.[11] During the outbreak in Liberia, technicians abandoned laboratories all over the country following the death of six laboratory workers. Africabio Enterprises was the first to provide biosafety training to 25 laboratory technicians who had chosen to assist in the crisis when their colleagues abandoned the laboratory.

"Building a sustainable payment system is a priority"

The training allowed the technicians to renew their confidence in their ability to carry out work safely, and provided an opportunity to share knowledge on working in a crisis. This lesson is an important one for future laboratory workforce development, *(cont'd on page 6)*

Reconstructing Laboratory Systems: How to Rebuild in Ebola-Affected Countries *(Con't from page 5)*

highlighting the need to build a culture where technicians know their lives are valued, and are empowered to confidently interpret results and solve problems.

Dr. Sall says that the Ebola response effort has developed a core group of people who, having worked through the crisis, have expertise in detecting Ebola, and who can serve as the foundation from which a robust laboratory workforce is built. In the wake of the economic damage the epidemic caused, this need for personnel is a promising avenue for socio-economic recovery. Ms. Eastman also feels that this workforce can be a powerful actor in country-led recovery efforts, stating, "Physicians, researchers, and allied professionals must begin to lead by example. It isn't only their plight, it goes beyond borders and resources-limited countries. We all know diseases have no boundaries in global health security."

By: Laurel Oldach (Editorial Team); Contributors: Amadou Sall, PhD (Institut Pasteur, Dakar), Candace Eastman (Africabio Enterprises, Inc.); Editors: Michele Merkel, MS (Editorial Team), Rosalie Whedbee, MPH (Editorial Team), Corey White, MPA (ASLM)

"Build a culture where technicians know their lives are valued, and are empowered to confidently interpret results and solve problems"

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[11] Getting Beyond Zero: UNDP Ebola ERR Support Framework

Developing a Laboratory Outbreak Preparedness Score Card: The Sierra Leone field Experience

Recognising the need for a coordinated plan to address all aspects of laboratory reconstruction in Sierra Leone, Dr. Isatta Wurie of the African Society for Laboratory Medicine (ASLM) and the Association of Public Health Laboratories (APHL) worked with the Ministry of Health and Sanitation to activate the National Laboratory Technical Working Group (LTWG) to develop laboratory system tools for effective outbreak response. Their aim was to define tools that articulate applications of systems required for the pre-analytical, analytical, and post-analytical laboratory process stages during an outbreak.

The process for tool development included an integrated approach incorporating other outbreak pillars such as epidemiology, surveillance, and case management. The ownership and coordination of the health sector LTWG was a critical step in generating audit tools and using existing platforms such as the adapted SLIPTA and total quality systems management tools to monitor defined indicators. A key output was the logical sequential collation of the tools into a Laboratory Response Manual (LRM), which contains the readiness preparedness criteria and kits in a Traffic-Light Scoring System (TLSS). The combined tools support laboratory response to attain the shortest possible turnaround time for testing and reporting of results for efficient actions through prompt diagnosis and reduction of transmission by: 1) reducing patient time in holding centres; 2) improving case management; and 3) monitoring epidemic trends.

Critical to achieving global health security is the inclusion of laboratory systems in public health decision-making processes toward an integrated disease surveillance and response (IDSR) strategy. The LRM will ensure a country is measuring and monitoring preparedness for potential biological threats according to the GHSA. The score card is divided into sections, each of which measures a certain aspect of the laboratory system, with emphasis on: political input; technical drivers, such as TWGs; bilateral relations; human resources needs; pathways for supply chain management, chain of custody, specimen transport, and cold chain; distribution and reach of laboratories; health and safety issues; quality management system requirements; data management; and use of research to support rapid response.

Dr. Wurie (center) surrounded by Global Attaché of lab experts in Sierra Leone.

The TLSS is a tool that can be used to motivate and facilitate countries to scale up laboratory systems not only for outbreak response, but also for ongoing assessment through laboratory-based surveillance. In Sierra Leone, the information generated through the use of the TLSS was beneficial in directing the response efforts and also in prioritising the needs of the laboratory system, which, Dr. Wurie stated, were overlooked in the initial Ebola response. Input from the Ministries of Health in Guinea and Liberia is currently being collated into a harmonised tool with country consensus. The tool will, however, be useful in many countries that have experienced outbreaks, and can be customised to ensure the information gathered is of the most value.

Critical to the effectiveness and sustainability of the score card will be the development of a corresponding investment plan that will cost all of the kits, ensuring countries know the exact resources necessary for preparedness, and determining the restructuring or financial commitment necessary. This way, a country can be proactive in their planning for a responsive laboratory system, avoiding the delays seen as a result of the Ebola outbreak.

The tool will have scope beyond individual country support. Dr. Wurie envisions a wider approach that includes buy-in from the African Union (AU), the Economic Community of West African States (ECOWAS), WHO-AFRO, and other trans-national entities to ensure that countries are reviewed at the highest level, and to align and prioritise activities and funding amongst GHSA partners and donors. Dr. Wurie notes, “This tool will put the laboratory on the map for rapid response.”

By: Rosalie Whedbee, MPH (GSSHealth); Contributor: Isatta Wurie, PhD (ASLM, APHL); Edited by: Michele Merkel, MS (GSSHealth), Corey White, MPA (ASLM)

A Revitalised Laboratory Declaration to Forge a Path for Action

DETECT

The Ebola epidemic brings to the forefront the imperative to reinforce healthcare and laboratory systems, which has resulted in national governments taking critical steps to close the vulnerabilities in these systems.

In light of the challenges uncovered in the outbreak response, how can governments effectively synthesise such information to establish resilient healthcare and laboratory systems accessible for Africa's 1 billion citizens?

One answer is by the creation of a new framework for operationalising functional and high-quality laboratory networks, aimed at meeting the needs of both public health and individual patients to address the GHSA. As such, the African Society for Laboratory Medicine (ASLM), with support from local and international partners, will table this new framework at a consensus meeting in Freetown, Sierra Leone, 15-16 October 2015, which aims to deliver much-needed practical guidance to Ministries of Health building upon the mandates of the Maputo Declaration of 2008.

The strengthening of healthcare systems stems from country leadership and is guided by seminal agreements such as the Maputo Declaration and the International Health Regulations[12] (IHR) set forth in 2005.[13] Specifically, signatories of the Maputo Declaration called for the development of robust laboratory systems for the detection of globally high burden diseases. The Declaration set the stage for laboratory strengthening and brought attention to the critical role diagnostic services play in controlling outbreaks.

Now, several years later, with first-hand experience of the devastation of inadequate healthcare systems, the GHSA has committed to work collaboratively to secure the safety of populations from infectious diseases. The laboratory system is a cornerstone of the GHSA, upon which many activities depend. Therefore, the development of a revised Maputo Guidance on Laboratory Strengthening is a relevant step for tackling the challenges of securing nations from biological threats. A revised Declaration "can serve as a guidance for how [governments] can address not only public health needs, but also individual patient needs," says Michele Best, Laboratory Director, Dimensions Healthcare System.

> ***A revised Maputo Declaration on Laboratory Strengthening "can serve as a Guidance for how [governments] can address not only public health needs, but also individual patient needs."***
> ***- Michele Best, Laboratory Director, Dimensions Healthcare System***

A new framework, Maputo 2.0, if grounded in critical lessons taken from those who were directly involved in recent outbreak responses, will be highly relevant for future use. Key areas that will be addressed are needs surrounding laboratory infrastructure, guidance on human resources, testing menus, tiered laboratory systems, public health and individual patient care needs. Importantly, the new framework shall be inclusive of other disciplines, specifically the clinical piece, as it relates to laboratories. By integrating strategic and implementation plans, a revised Maputo would pave the way for national policies and strategic and operational plans to be updated. New effective guidance to address the GHSA can forge a clear path of action for leaders, healthcare workers and patients themselves to prevent, detect and respond to public health emergencies of international concern.

By: Michele Merkel, MS (Editorial Team); Contributor: Michele Best, MS (Dimensions Healthcare System); Editor: Rosalie Whedbee, MPH (Editorial Team), Corey White, MPA (ASLM)

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Settling the Score: How a Laboratory Network Assessment Tool Can be Used to Score Functionality

Before disaster strikes and a locally contained outbreak becomes a global epidemic, how can the international community work together to minimise loss of life and economic upheaval? Viro-immunologist Dr. Pascale Ondoa thinks the answer could lie in a tool used to quantify laboratory network functionality across the globe. Currently in development by the Amsterdam Institute for Global Health and Development (AIGHD), the Dutch Royal Tropical Institute (KIT), and the African Society for Laboratory Medicine (ASLM), the tool would serve as a scorecard of sorts, with numerical denotations of laboratory preparedness and adherence to regulations. Based on the score a laboratory network receives upon evaluation, leadership will have a clear cut understanding of what must be improved in order to effectively respond in times of crisis.

This strategy of preparedness is particularly resonant in the wake of recent emergency response shortcomings seen in the Ebola or MERS outbreaks. [14,15] Dr. Ondoa lamented the failures of Ebola response, saying, "WHO and countries have recognised that compliance to international health regulations was not achieved, so many countries were ill-prepared for this type of international crisis. GHSA is now pushing forward a way to implement international health regulations." The GHSA, which stresses prevention, detection, and response as key actions in combating infectious disease threats, is the framework upon which the scorecard will be based, streamlining the laboratory specific regulatory guidelines from a variety of sources in a One Health approach. Rather than taking a disease-specific approach to network assessment, the proposed tool will create a uniform framework on which to base its analysis, so its application can be as broad as possible. Rather than focusing on individual laboratories, the tool will assess public health laboratories at the system level, measuring a network's ability to effectively communicate and respond to threats by following international health regulations.

Graded assessments, such as the WHO Laboratory Assessment Tool (LAT), are an important way to clearly identify existing gaps so that performance-based solutions can be developed and implemented effectively. Initial use of a laboratory preparedness scorecard, a graded assessment for outbreak response, has proved to be a useful tool in laboratory reconstruction plans in Sierra Leone.

By consolidating aspects of narrower, disease-specific assessments for individual laboratories, the tool will be able to quantitatively measure laboratory networks of varying capacities in any given country. Since the tool is still in its formative stages, some details of its implementation remain unformed. ASLM is experimenting with the idea of using its Stepwise Laboratory Quality Improvement Process Towards Accreditation (SLIPTA) assessors to administer the laboratory network scoring, since they are already trained to evaluate laboratory systems. SLIPTA is a framework to measure laboratory systems' progress toward international accreditation in accordance with ISO 15189 standards. According to ASLM, the SLIPTA assessors might very well be the most qualified candidates to handle a tool designed to measure laboratory network functionality.

The WHO Laboratory Assessment Tool (LAT) system will serve as an important basis in the development of the tool. Another source of inspiration comes from a framework developed by the US Centers for Disease Control and Prevention (CDC) to evaluate the progress of nursing and midwifery professional regulation in sub-Saharan Africa. Designed as a "capability maturity model," measuring progress through a series of steps, the framework is able to track the impact of a US Government initiative to strengthen regulations over the course of several years. Similarly, Dr. Ondoa wants the laboratory assessment tool to be administered in a series of steps, *(Cont'd on page 10)*

Settling the Score: How a Laboratory Network Assessment Tool Can be Used to Score Functionality *(Cont'd from page 9)*

so that as a country advances a step in the framework, it is able to focus on a new set of goals before it can advance again, ultimately leading to full compliance with international health regulations. Dr. Ondoa states, "For now we are thinking of having the system in five steps of capability. That is the whole complexity, […] developing metrics that are quantitative enough to be configured into steps." This validates the need for a score to be given to laboratory networks, so that countries can understand their progress in numerical increments as laboratory networks advance through the five steps. Dr. Ondoa estimates that within one to two years of capacity building, the tool can be used again to determine whether countries have progressed to the next stage.

While many of the overarching ideas of how the tool will operate have been formulated, there is more work to be done before the tool is finalised. There must be consensus on the core capacities of the tool and the questions and related metrics that will be used to assess functionality.

The CDC has identified four distinctive global disease threats that the international community should be aware of: the emergence and spread of new microbes; globalisation of travel and trade; rise of drug resistance; and potential use of laboratories to make and release dangerous microbes.[16] With all of these threats putting public health at risk, full adherence to GHSA regulations seems more necessary now than ever before. The growing trends of travel and trade mean that an outbreak in one country is a threat to global health, and one country alone cannot be expected to have the capacity to manage a full-blown epidemic. We must rely on international cooperation if we are to prevent, detect and respond effectively. Dr. Ondoa hopes that with the laboratory network functionality assessment tool, countries will benefit from direct clarification of the areas where their laboratory networks need improvement. If implemented effectively, the tool will advance a uniform standard of laboratory networks that all countries can realistically achieve by following the steps to full functionality.

> ***"We must rely on international cooperation if we are to prevent, detect and respond effectively"***

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Guidance on the Regulation of New Diagnostics in Time of Outbreak

RESPOND

At the beginning of the Ebola outbreak in West Africa, no regulatory-approved, mass-produced Ebola in vitro diagnostics (IVDs) existed, yet specifics of the disease required timely diagnostic testing. Urgent demand for Ebola IVDs revealed inadequacy of internationally accepted conventional regulatory mechanisms and the need for fast, efficient regulatory procedures to bring new diagnostics to the affected countries.

In line with GHSA goals, the African Society for Laboratory Medicine (ASLM) is aiming to change the regulatory landscape in African countries by proposing a guidance document for rapid evaluation of diagnostics in times of outbreak. According to Dr. Elliot Cowan, Principal at Partners in Diagnostics, LLC, this document will define a framework for adequate response to triggers to contain future outbreaks. It will outline policy, and will focus on regulatory and legal components of a diagnostic evaluation process.

Dr. Cowan emphasised that approval of a diagnostic product is a risk-based decision based upon thorough review of scientific data and manufacturing processes. In the case of the World Health Organization pre-qualification (WHO-PQ) Programme, the review also includes product evaluation in the laboratory. Such processes are designed to prevent sub-standard products from entering the market. However, emergency situations dictate lowering the threshold of what is considered adequate scientific evidence and waiving requirements for manufacturing processes. As a result, the risk profile of a diagnostic product authorised for use in an emergency situation is dramatically different from that considered acceptable upon a conventional regulatory review.

> ***"We cannot be thinking only about Ebola; today's Ebola tomorrow could be something else."***
> ***-Dr. Elliot Cowan, Principal at Partners in Diagnostics, LLC***

Adequate regulatory mechanisms for emergency situations should maintain a fine balance between the necessity of introducing IVDs and the thoroughness of product review, because both delays and inadequate product safety, effectiveness, and quality may cost lives. Examples of such regulatory mechanisms for authorisation of use of unapproved diagnostics in a state of emergency, when approved alternatives are not available, include the well-functioning Emergency Use Authorization (EUA) in the United States[17] and WHO's Emergency Use Assessment and Listing procedure (EUAL).[18] EUA is granted based upon several criteria; it is conditional, and it is valid only for a defined period of time. Between August 2014 and July 2015, the US Food and Drug Administration (FDA) issued ten EUAs for Ebola IVDs. WHO developed the EUAL for IVD candidates for use in the context of a public health emergency as a measure to confine the Ebola outbreak. This accelerated procedure included review of manufacturing and quality management system (QMS) documentation, technical review of IVD safety and performance characteristics, and laboratory evaluation by an independent party. Using EUAL, WHO listed six Ebola IVDs as eligible for international procurement.[20] Importantly, both WHO EUAL and US FDA EUA are not approvals of diagnostics but rather special procedures invoked to satisfy a demand during a specific time period.

Dr. Cowan stressed that upon emergency authorisation, laboratory testing of and comparison between diagnostic candidates becomes an indispensable part of a diagnostic evaluation, as available scientific evidence of diagnostic safety and effectiveness may be not sufficient. In such situations, timely information sharing is critical. Even more critical is sharing of well-characterised specimens, as it enables product development, and allows for comparison of different diagnostic tests and understanding of their performance characteristics.

Incorporation into national guidelines and implementation of the guidance for rapid evaluation of diagnostics in the time of outbreak will help shorten or completely avoid a period of diagnostic "vacuum" in the event of the next life-threatening disease outbreak.

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Improving Disease Surveillance Through A Community-Tailored Framework

The recent Ebola outbreak exacerbated weak points in disease surveillance, highlighting the need for renewed attention to improving disease surveillance systems. These weak points, which may have gone unnoticed had they not been exposed to the unprecedented scale and severity of the Ebola outbreak, meant that many cases were delayed in discovery and reporting. Initial passive case finding in response to the situation meant that control efforts were always one step behind the outbreak. Recognising the need to improve disease surveillance networks to prevent a similar situation from occurring, the GHSA includes "Real-Time Surveillance" as an Action Package. This Action Package emphasises the importance of a One Health approach, aims to improve indicator and events based surveillance, and strives to bolster the communication between various sectors across all levels of the health system. These aims will be achieved by connecting epidemiologic, clinical, laboratory, environmental testing, product safety, and bioinformatics data and shortening the time between the generation and the receipt of said data to within 60 minutes, allowing countries to analyse and respond in the timeliest manner.[21] For a disease surveillance network to be effective and responsive, as Dr. Amadou Sall of the Institut Pasteur noted, it must be an interconnected system comprised of all levels of human, animal, and environmental surveillance; connecting jungle observatoires to national reference laboratories and everything in between, and linking them all to a single alert system.

The East African Community (EAC) has seen great success in disease surveillance following the formation of the East African Integrated Disease Surveillance Network (EAIDSNet). The EAIDSNet has demonstrated the feasibility of a One Health approach to regional disease surveillance activities through cross-country and cross-sector collaboration and the appropriate exchange of IDSR related information, expertise and best practices.[22] These efforts have improved disease surveillance activities in member countries and the region.

While there are many valuable lessons to be learned from the implementation and improvement of disease surveillance networks across the African region, Dr. Sall stressed that it is critical that the policies and practices of an existing disease surveillance system are not rigid standards to which all other systems subscribe. Rather, it will be important for countries to design a system based on their own experience; streamlining World Health Organization (WHO), GHSA, and other regulatory guidance and adapting based on local experience.

Dr. Sall stated that a key method of not only broadening and strengthening disease surveillance systems, but also of tailoring them to their setting, is to engage local communities. A community based approach, in which community members are trained to detect trigger events associated with specified health events, can be combined with other surveillance activities to make a robust and responsive surveillance network. Incorporating communities into surveillance networks will strengthen the system in a variety of ways. First, expanding the networks into communities will allow for active, syndromic surveillance rather than passive surveillance that will improve the sensitivity for targeted diseases. Secondly, civilian involvement will create and improve relationships between the community and local health systems, strengthening local ownership of and buy-in to the programme. Finally, community members provide unparalleled local knowledge, and up-front experience with the effects of Ebola on the ground.

The WHO has recognised the valuable role that the community can play in disease surveillance and has advocated for its inclusion in its addendum to the Guidelines for Integrated Disease Surveillance and Response (IDSR), Integrated Disease Surveillance and Response in the African Region: A Guide for Establishing Community Based Surveillance. It is now up to country leaders to determine the role of the community when developing a guidance framework for the establishment and strengthening of functional public health laboratory networks.

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Once an Ignored Threat, Antimicrobial Resistance Becomes an International Priority

Antimicrobial Resistance (AMR): A Looming Danger

Antimicrobial resistance, a phenomenon in which microorganisms are able to survive antimicrobial treatment such that drugs become ineffective, is an ever-growing problem of international public health importance.[24] Present everywhere in the world, drug-resistant parasites, bacteria, viruses and fungi jeopardise the effective prevention and treatment of infections.[25] Over the past several years, the World Health Organization (WHO) has reported an increase in drug-resistant HIV, malaria and tuberculosis (TB), a development that threatens progress towards their elimination.[26]

Though the evolution of drug-resistant microorganisms is a naturally-occurring phenomenon, drug resistance is hastened by factors such as antimicrobial misuse and inadequate infection prevention and control practices.[27] Unfortunately, scientists are not able to develop new antimicrobials as quickly as pathogens are developing resistance to existing treatments.[28] Drug-resistant infections, which currently kill hundreds of thousands of people each year, could kill up to 10 million people per year by 2050 if not addressed at international, national and regional levels of public health governance.[29]

Drug resistance is hastened by factors such as antimicrobial misuse and inadequate infection prevention and control practices

Global Priorities to Address AMR

Governments, industry leaders, public health agencies and research organisations are increasingly turning their attention to the issue of drug resistance, with health stakeholders coordinating efforts to prevent and control drug-resistant infections, strengthen surveillance, advance the use and development of drug resistance testing, and increase research toward the creation of new antimicrobial drugs.[30] Organisations including WHO, the GHSA, the United Nations Food and Agriculture Organization (FAO), and the World Organisation for Animal Health (OIE), among others, are partnering to develop integrated plans to address the human, animal, agricultural and environmental aspects of antimicrobial resistance, collaborating with countries to strengthen prevention, surveillance and laboratory capacity to fight drug resistance.[31]

Testing for Resistance: A Critical Activity Area

Testing for drug resistance is a key strategy to minimise antimicrobial resistance and allows healthcare practitioners and patients to make informed choices about treatment and prevent the spread of resistant infections in their communities. When attempting to identify whether a patient has developed a drug-resistant infection, healthcare professionals often turn to the laboratory for determination.[32] For many common bacterial and fungal infections, laboratories can conduct antimicrobial susceptibility testing to determine drug resistance; when testing needs lie beyond the capacity of routine laboratories, samples are often referred to reference laboratories.[33] Drug resistance and susceptibility testing options are available for HIV, TB and malaria, though testing may be difficult in resource-limited settings due to infrastructural and supply chain constraints.

There is a need for further investment in affordable, accurate and portable POC diagnostics for testing, which would allow public health stakeholders to circumvent time-consuming laboratory-based resistance and susceptibility testing methods and to reach users at the peripheral level of the healthcare system. *(Cont'd on page 14)*

Once an Ignored Threat, Antimicrobial Resistance Becomes an International Priority *(Cont'd from page 13)*

The GHSA Antimicrobial Resistance Action Package: A Collaborative Approach to Address Drug Resistance

The Antimicrobial Resistance Action Package is one of 11 Action Packages developed by the GHSA to advance regional and international targets to combat AMR.[34] The Action Package serves not only to direct the complex conversation surrounding AMR, but also to provide determinate methods to prevent and control AMR at the international, national, regional and local levels. Within five years, through concerted partnerships with WHO, FAO, and OIE, the GHSA aims to help plan and implement the following:

- **International-level AMR guidance;**
- **Country-level comprehensive plans to combat AMR;**
- **Nation-to-nation twinning frameworks whereby countries assist each other in the implementation of AMR-related activities;**
- **Surveillance and laboratory capacity-strengthening activities and adherence to agreed-upon international standards on AMR;**
- **Better safeguarding of existing antimicrobial treatments; and**
- **Support for new antimicrobials, alternative drug treatments, AMR prevention activities, and POC diagnostics.**

The goal of the GHSA and collaborating partners is to significantly curtail AMR through an effective, multi-pronged approach consisting of prevention, surveillance, control, testing, and treatment activities operating under clear policy and action frameworks. Through investment on the part of countries and stakeholder organisations, communities around the world may have access to appropriately prescribed, well-regulated and quality-assured antimicrobial treatments.

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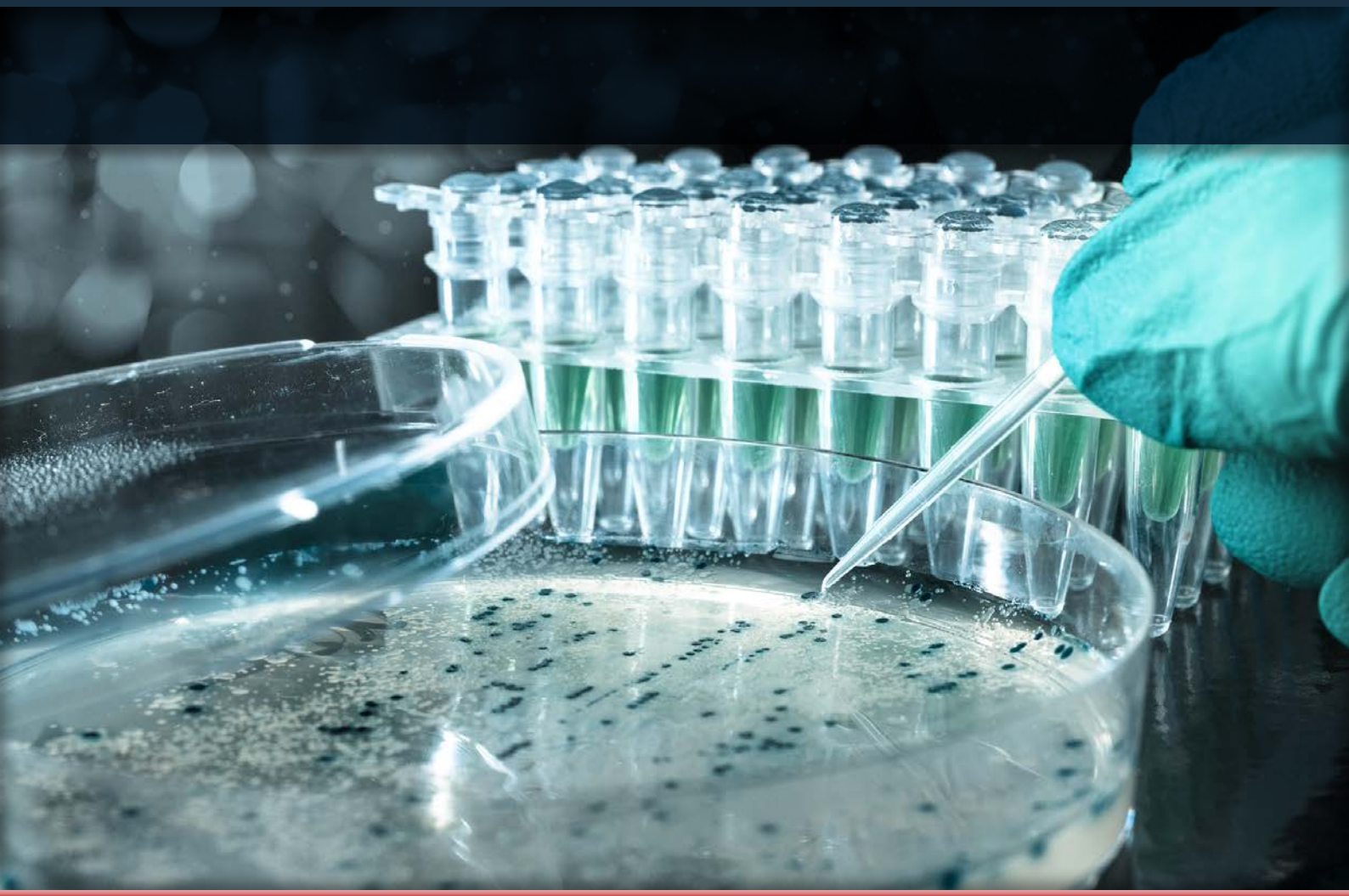

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