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LABORATORIES ON THE FRONTLINE: THE ESSENTIAL ROLE OF PUBLIC HEALTH LABS IN DETECTING, CONTAINING, AND COMMUNICATING THREATS DURING EMERGENCIES AND ARMED CONFLICTS

Introduction

This issue of the EMPHNET Emergency Bulletin highlights the critical role of public health laboratories as a cornerstone of health security in fragile and crisis-affected settings. It explores how laboratories function as the first line of defense in detecting outbreaks early, confirming diagnoses, and guiding timely response actions during emergencies and armed conflict. The issue also sheds light on the operational and logistical challenges faced by lab systems in disrupted environments, including shortages of supplies, limited infrastructure, workforce constraints, and difficulties in maintaining quality assurance and biosafety standards.

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Diagnostic Under Fire: Core Functions of National Public Health Laboratories During Outbreaks and Armed Conflict

By Prof. Aamer Ikram, Vise President of the International Association of National Public Health Institutes (IANPHI), and TEPHINET Advisory Board Chair

There is a question I have returned to many times across my career in pathology and public health: what does it actually take for a laboratory to function when everything around it is failing? Not in theory, not in the clean architecture of preparedness frameworks and policy documents, but in practice, when the power cuts out at midnight, when the cold chain has been broken for three days, when the laboratory technician has not been paid in two months, or when the reagents ran out last week. It is in those moments, rather than in moments of abundance, that the true core functions of a national public health laboratory reveal themselves.

I have worked at the intersection of laboratory systems, outbreak response, and health system resilience for decades, and my experience has taught me that laboratories are simultaneously the most technically demanding and the most chronically undervalued component of any public health architecture. During the COVID-19 pandemic, the world briefly understood what those of us in this field had always known: without laboratory confirmation, there is no surveillance; without surveillance, there is no response; without response, there is only catastrophe.

Laboratories as the First Witness

When Pakistan confronted the early months of the COVID-19 pandemic, the National Institute of Health (NIH) in Islamabad faced a challenge that was at once scientific, logistical, and deeply human. Diagnostic capacity needed to be expanded from a handful of reference laboratories to a national network in a matter of weeks. Supply chains for PCR reagents, viral transport media, and biosafety consumables, most of them anchored to international manufacturers, had been disrupted globally. The demand from every province and region, every hospital, every airport was immediate and overwhelming.

What was witnessed during that period confirmed something I had long believed: a public health laboratory's core function is not simply to run tests; it is to generate trusted, timely, and actionable information that enables decision-makers to act. The distinction matters enormously. A test result that arrives in seventy-two hours during a rapidly evolving outbreak is, in many operational respects, worse than no result at all because it creates a false sense of diagnostic coverage while the transmission window has already closed. Speed, quality, and communication are not optional attributes of good laboratory performance, they are the essential products.

Pakistan's polio eradication program taught me the same lesson through a different lens. The environmental surveillance network, detecting poliovirus in wastewater long before a paralytic case appears, is one of the most elegant applications of laboratory science to population-level public health. It is a system that works not because the laboratories are the most sophisticated in the world, but because they are integrated into a program that understands exactly what it needs from a laboratory, and a laboratory is designed precisely to deliver it. That alignment between laboratory function and public health purpose is rarer than it should be, and it is the feature most likely to be destroyed when health systems come under stress.

When the Context Becomes Hostile

Armed conflict and protracted emergencies, as we witness in certain parts of the world, impose a distinct and particularly cruel set of challenges on laboratory systems. The issues are not simply a more severe version of the resource constraints that characterize low-income health systems at baseline. They are qualitatively different: infrastructure is physically destroyed; supply routes become dangerous or impassable; skilled personnel are displaced or may suffer harm; and the governance structures that authorize procurement, ensure quality assurance, and enforce biosafety standards either fragment or disappear entirely.

In such settings, the temptation, understandable but dangerous, is to abandon the standards that define laboratory quality in the name of emergency pragmatism. Biosafety protocols are shortened or neglected. Quality controls are skipped. Results are reported without adequate validation because the political pressure to show diagnostic numbers is intense. This pattern has been witnessed in multiple settings in fragile areas, and its consequences: laboratory-acquired infections among already overstretched health workers; misclassified cases that misdirect response resources; and perhaps most damaging of all, a gradual erosion of institutional trust in laboratory data that takes years to rebuild.

The core functions of a national public health laboratory, disease confirmation, reference testing, surveillance support, outbreak investigation, and quality assurance of the broader testing network do not become less important in conflict settings. They become more important, and more difficult, simultaneously. The response to that challenge cannot be the abandonment of standards. It must be the development of conflict-adapted operational protocols that preserve the integrity of laboratory function within the constraints of the context.

Biosafety as Non-Negotiable Infrastructure

Of all the dimensions of laboratory performance that has been observed under pressure, biosafety is the one most consistently treated as a luxury rather than a necessity. This is a misunderstanding with potentially catastrophic consequences.

A Biosafety Level 3 (BSL-3) laboratory is not a prestige project. It is the physical and procedural capacity to safely handle pathogens that are transmitted by inhalation and can cause serious or potentially lethal disease, precisely the category of pathogens most relevant to the high-consequence outbreaks that demand the fastest and most reliable laboratory response. Without that infrastructure, a national public health laboratory is, in critical respects, blind to its most dangerous threats.

The current Ebola outbreak driven by Bundibugyo virus, the documented human-to-human transmission of Andes hantavirus aboard a cruise ship, and the persistent threat of emerging respiratory pathogens all underscore this point. Diagnostic laboratories confronting these agents without appropriate containment infrastructure not only fail to protect their staff but create secondary transmission risks that can amplify the very outbreak they are trying to characterize. Biosafety, in this sense, is not a constraint on laboratory function. It is a precondition for it.

Communication: The Function Most Often Overlooked

Laboratory science produces data, and public health requires information. The transformation of one into the other, through interpretation, contextualization, and communication, is a function that sits formally outside most laboratory mandates but is in practice inseparable from the laboratory's public health value.

During COVID-19, some of the LMICs observed that the laboratories generating technically valid results but communicating them in formats that were inaccessible to the clinicians, epidemiologists, and policymakers who needed to act on them. Just to mention positivity rates were shared without denominators that would allow meaningful interpretation; and sequencing data arrived weeks after it would have influenced response decisions. The problem was not scientific competence; it was the absence of a structured interface between the laboratory and the public health decision-making system it was meant to serve.

In conflict settings, this communication gap widens further; laboratory networks fragment, reporting chains are interrupted, and informal relationships between laboratory directors and national surveillance coordinators, which in stable systems compensate for structural gaps, are severed when key personnel are displaced. Rebuilding these relationships and formalizing these communication pathways must be a deliberate and explicit component of laboratory resilience planning.

What Resilience Actually Requires

Sometimes we are asked what it would take to make national public health laboratories genuinely resilient, not resilient in the sense of surviving, but resilient in the sense of continuing to perform their essential functions when the context makes that hardest. My answer, shaped by decades of experience across different systems and different crises, is consistently the same: it requires investment in people before infrastructure, in systems before technology, and in relationships before protocols.

The laboratories that continued to function during COVID-19, those that expanded capacity rapidly, maintained quality, and communicated effectively, were not necessarily the ones with the most advanced equipment. They were the ones with trained, experienced staff who understood both the science and the public health system they were serving; with governance structures that could make decisions quickly; with supplier relationships and stockpile strategies that provided some buffer against disruption; and with a culture of quality that had been built over years, not instituted by emergency decree.

For countries in the Eastern Mediterranean Region (EMR), many of which face the compounding challenges of resource limitation, ongoing conflict, and growing zoonotic and emerging infectious disease threats, but under the One Health, the investment case for national public health laboratory strengthening is not difficult to make. It is, frankly, one of the most straightforward investments in health security available. The question is whether the political will and the international support can be sustained beyond the acute phase of any given crisis.

Laboratories do not make headlines when they are functioning well. That invisibility is, in one sense, the mark of their success. But it also makes them vulnerable to the chronic under-investment that leaves health systems exposed when the next outbreak arrives. If there is one lesson we would want policymakers and public health leaders to carry from this period of extraordinary infectious disease pressure, it is: the laboratory is not a support service, it is a frontline function, and frontline functions require frontline investment.

Mobile Laboratories and Decentralized Diagnostics: Closing the Access Gap in Humanitarian Settings

By Dr. Ghassan M. Matar, Chairperson & Tenured Professor, Department of Experimental Pathology, Immunology & Microbiology, Faculty of Medicine, American University of Beirut

A laboratory result is never simply a line on a report. Behind every specimen is a patient waiting for an answer, a clinician deciding on treatment, and often a family living with uncertainty. After more than four decades in microbiology and infectious diseases, I have come to see timely diagnosis as one of the most important, and still most unevenly distributed, components of healthcare.

Traditional laboratory systems depend largely on centralized facilities. In stable settings, specimens can be transported, tested, and reported within a reasonable timeframe. In humanitarian emergencies, however, each of these steps may become difficult. Roads may be unsafe, transportation interrupted, electricity unreliable, and patients displaced before their results become available.

In such circumstances, delayed diagnosis is not merely an operational problem. It may result in delayed treatment, unnecessary antimicrobial use, missed transmission chains, and outbreaks detected only after they have spread. This is why diagnostics must increasingly move closer to patients and frontline health workers.

Working in Lebanon has made this need particularly tangible. Our health system has continued to function through prolonged instability, economic hardship, displacement, the Beirut port explosion, the COVID-19 pandemic, and the re-emergence of cholera. Although each crisis was different, all reinforced the same lesson: effective public health action depends on timely and reliable laboratory information.

During COVID-19, molecular testing and genomic surveillance helped identify cases, monitor transmission, and understand how the virus was evolving. Our work in Lebanon contributed to the genomic and epidemiological characterization of SARS-CoV-2, illustrating how laboratory data can support both clinical decisions and public health preparedness.

The 2022-2023 cholera outbreak provided another important example. Through genomic epidemiology, my colleagues and I identified an unusual outbreak involving two Vibrio cholerae strains. Combining laboratory and epidemiological information helped us better understand the outbreak and demonstrated the value of advanced diagnostic capacity. Yet, it also highlighted a persistent limitation: even the most advanced reference laboratory can have limited impact when specimens cannot reach it in a timely manner.

Mobile laboratories and decentralized diagnostic platforms can help address this gap. Portable PCR instruments, rapid molecular assays, compact sequencing technologies, and digital reporting systems now allow reliable testing to be performed closer to affected communities. During the Ebola outbreak in Guinea, for example, portable sequencing equipment was deployed in the field and produced genomic results within approximately one day of receiving positive specimens, demonstrating that advanced surveillance could be conducted close to an outbreak rather than in distant laboratories.

However, technology alone is never enough. A portable instrument cannot replace trained personnel, reliable supply chains, quality assurance, biosafety, maintenance, or clear systems for communicating and acting upon results. Mobile laboratories must therefore be integrated into national laboratory networks rather than operate as temporary or parallel structures.

Decentralization should bring laboratory standards closer to communities, not lower those standards.

A resilient system may include rapid testing at community health centers, molecular confirmation through mobile or regional laboratories, and genomic characterization and quality oversight at national reference centers. Each level should perform what it can reliably do while remaining connected to the wider surveillance system.

This principle has guided much of my own work. What began as a molecular microbiology laboratory at the American University of Beirut evolved into a platform supporting molecular diagnostics, genomic sequencing, antimicrobial resistance surveillance, and outbreak investigation. The establishment of the Center for Infectious Diseases Research and the WHO Collaborating Center for Reference and Research on Bacterial Pathogens showed how sustained investment in laboratory capacity can become a national and regional asset during emergencies.

Regional collaboration is equally important. Pathogens do not stop at borders, and laboratory cooperation should not stop there either. Networks such as PulseNet enable countries to share expertise, methods, genomic information, and quality-assurance practices. My experience with regional surveillance initiatives has reinforced my belief that no laboratory, however advanced, can protect public health in isolation.

The future will bring smaller instruments, faster assays, and increasingly portable sequencing platforms. Yet, success should not be measured by the sophistication of the technology. It should be measured by the time saved, the uncertainty removed, and the action made possible: a clinician selecting the appropriate treatment, an outbreak team intervening earlier, and a community no longer excluded from accurate diagnosis because it is difficult to reach.

Behind every specimen is a person waiting for an answer. Our responsibility is to ensure that the answer reaches them in time.

Photo@Lebanese American University

The Sudan National Public Health Laboratory Under Crisis: Lessons in Collapse, Continuity, and Recovery

By Dr. Mubarak Karsany, Director General, National Public Health Laboratory, FMoH, Sudan

Abstract

The armed conflict in Sudan, which erupted in April 2023 between the Sudanese Armed Forces (SAF) and the Rapid Support Forces (RSF), has severely disrupted the nation's health system. Prior to the conflict, Public Health Laboratories (PHLs) served as the foundational pillars for disease surveillance, epidemic response and health research.

This paper examines the dual operational crisis faced by Sudanese PHLs during active warfare comprised of the structural breakdown and physical occupation of the National Public Health Laboratory (NPHL) which is the central diagnostic assets in Khartoum, and the loss of diagnostic services across conflict and non-conflict zones. It also evaluates the biological risks associated with the displacement of diagnostic infrastructure, analyzes the compounding burdens of disease outbreaks and severe resource scarcity, and documents the grass-roots and institutional mechanisms, such as Emergency Response Rooms (ERRs) and regional laboratory decentralization—that have maintained basic survival care during the last three years of this ongoing conflict.

Introduction

Prior to April 2023, Sudan maintained a fragile healthcare ecosystem. The Sudanese health sector was supported by centralized diagnostic and research nodes, most prominently the NPHL, historically known as "Stack Laboratory" in central Khartoum. This facility served as the country's primary diagnostic hub against endemic infectious diseases such as malaria, dengue fever, measles, cholera, and polio and tuberculosis, supported by six state public health labs. However, this network did not cover all 18 states of Sudan.

The onset of full-scale urban combat transformed most of healthcare facilities and labs in nine states from protected humanitarian zones into strategic targets and battlegrounds. The systematic targeting, occupation, and looting of public health facilities led to a systemic collapse: over 70–80% of health infrastructure in hot zones became non-functional within months.

Understanding the trajectory of Sudanese PHLs during wartime requires examining two interrelated levels:

- Public Health Laboratories (PHLs): crucial for biological surveillance, pathogen isolation, and outbreak verification.
- Health Emergency Operations Centers (PHLs/HEOPCs): the primary contact point for outbreak investigation and response on national, federal, and state levels.

Structural Breakdown and Military Occupation

Occupation of Central Assets and Bio-safety Threats

In late April 2023, early in the battle for Khartoum, military forces occupied the NPHL, the technical staff were forcibly evacuated, and the facility was converted into a military position by the RSF.

The occupation created critical biological safety risks including:

- Pathogen Exposure & Loss of Containment: for several decades, the National laboratory has served as a biobank, storing archived isolates of high-consequence pathogens, including Vibrio cholerae, poliovirus, measles virus, and multi-drug-resistant Mycobacterium tuberculosis, as well as entomological specimens. These materials were stored in a biosafe and biosecure environment. However, the biobank was completely lost or looted during the conflict.
- Power and Cold Chain Disruption: combat-related power cuts and generator failures compromised cold-chain storage, threatening the integrity of biological samples, diagnostic reagents, and blood bank stocks.
- Loss of Reference Diagnostic Capacity: the occupation severed the national link for confirmatory testing and epidemiological surveillance, leaving local field teams without reference facilities to verify disease outbreaks. (2) (3)

Supply Chain Collapse and Asset Destruction

Across major conflict zones, including Khartoum, Darfur, and Kordofan, public health laboratories faced extensive looting of essential supplies as mentioned above. Medical devices, reagents, backup power generators, and cold-chain equipment were stripped or destroyed. Concurrent blockades on fuel and logistics routes rendered the transport of clinical samples and medical consumables between states nearly impossible.

Operational Impact on Disease Control and Public Health

Epidemic Outbreaks in a Surveillance Vacuum

The destruction of diagnostic laboratories coincided with severe sanitary degradation, mass population displacement, and structural damage to water systems. The resulting surveillance gap exacerbated concurrent infectious disease outbreaks with limited lab support:

- Cholera & Vector-Borne Diseases: cholera outbreaks expanded rapidly across eastern and central states during September 2023 and June 2025, while malaria and dengue fever spiked following rainy seasons without systematic vector control or diagnostic tracking.
- Vaccine-Preventable Pathogens: disruptions to primary care vaccination programs led to resurgences of measles and circulating vaccine-derived poliovirus outbreaks in several states. (4)
- Laboratory Diagnostic Delay: without functional reference labs, field clinicians were forced to rely on syndromic management rather than confirmatory testing, increasing the risk of antimicrobial resistance and inappropriate treatment protocols.

Strain on Front-line Primary Care

At the primary care level, health centers were overwhelmed by millions of internally displaced persons (IDPs) moving into safer states (such as Red Sea, River Nile, and Kassala) or remaining trapped in active conflict zones.

Metric / Dimension	Pre-War Baseline	Wartime Status
Functional Health Facilities	**~70-80%** operational nationwide	**<20-30**% in active conflict zones
Central Diagnostic Hub	NPHL fully operational in Khartoum	Evacuated; relocated to Port Sudan
Primary Disease Burden	Chronic disease, endemic malaria	famine/malnutrition, cholera, trauma, and measles
Supply Chain Delivery	Centralized via national medical Supplies	Disrupted by blockades, looting, and fuel shortages

Resilience, Adaptation, and Community Response

Despite severe challenges, public health professionals and local communities adapted through several structural shifts:

Relocation and Decentralization of NPHL Functions

In response to escalating conflict and the urgent need to decentralize diagnostic capabilities, NPHL spearheaded a strategic equipment distribution initiative across state-level PHLs. This action aimed to enhance testing capacity, biosafety standards, and regional resilience. By supplying advanced diagnostic tools, including real-time PCR systems, ELISA readers, centrifuges, biosafety cabinets, incubators, freezers, and autoclaves, to six key states, NPHL significantly expanded molecular, serological, and microbiological readiness. The effort not only safeguarded surveillance continuity during system disruption, but also laid the foundation for decentralized response to outbreaks and antimicrobial resistance threats.

Rapid Diagnostic Testing (RDT) Protocols

Because centralized laboratory equipment (e.g., PCR machines, culture incubators) was largely inaccessible or non-functional due to power failures, clinical management shifted toward point-of-care Rapid Diagnostic Tests (RDTs) for cholera, malaria, and HIV, alongside simplified syndromic management protocols.

Rehabilitation and Resilience Stage

To prevent the total collapse of public health infrastructure and mitigate ongoing biological and epidemiological risks, key solutions were sought including:

- Support decentralized diagnostics: invest in regional public health laboratories across stable and safe states rather than relying on a single, centralized capital hub, reducing vulnerability to single-point failure.
- Sustain mobile laboratory services: through direct funding from IGAD and UN agencies, maintain mobile laboratory services using equipped four-wheel-drive vehicles with solar-powered cold-chain equipment and diagnostic supplies, enabling the delivery of essential services to hard-to-reach states and supporting Emergency Response Rooms (ERRs) in maintaining frontline care.
- Re-establish biosafety surveillance: conduct comprehensive biosafety assessments of occupied or damaged laboratory facilities as access permits to prevent pathogen leaks and ensure safe decontamination.

Conclusion

The destruction and disruption of public health laboratories in Sudan highlight the severe vulnerability of a centralized health systems during war. The occupation of central laboratory facilities created biosafety risks and weakened disease surveillance at a time of heightened public health need. Rebuilding Sudan's public health laboratory infrastructure will require a transition from fragile, centralized models toward resilient, regionally decentralized primary care and diagnostic networks capable of maintaining services.

Photo@WHO

In Numbers

This section presents key concerning statistics on the Ebola outbreak, along with emergency-related figures from various countries in the EMR.

Outbreaks | Ebola Disease

- **6757** confirmed cases in the DRC, as of September 7, 2026.
- **3267** deaths among the confirmed cases in the DRC, as of September 7, 2026.
- **48.3%** case fatality ratio recorded in the DRC, as of September 7, 2026.
- **1,590** patients recovered in the DRC as of September 7, 2026.

Gaza

1,358
people have been killed since the announcement of the ceasefire agreement on October 10, 2025, as of September 6, 2026.

4,541
people have been injured since the announcement of the ceasefire agreement on October 10, 2025, as of September 6, 2026.

~50%
of reported communicable diseases were acute respiratory infections, followed by 29.5% skin diseases and 21% acute watery diarrhea, between August 10-30, 2026.

30
Emergency Medical Teams (EMTs) are operational, including 104 national and 68 international personnel, as of September 8, 2026.

88%
of assessed households reported facing challenges in accessing safe and clean sanitation facilities.

>1.4 million
(67% of the population) are expected to face crisis or worse levels of acute food insecurity in July-December 2026.

~3,000
children aged 6-59 months were admitted for malnutrition treatment in July, compared with >3,100 in June 2026. This includes over 380 with Severe Acute Malnutrition in July compared with over 400 in June (source: Nutrition Cluster).

~24,600
pregnant and breastfeeding women are expected to require nutrition treatment or support between May 2026 and April 2027.

Sudan

153
facilities/services were suspended, and 182 were operating at reduced capacity across 13 states due to continued funding reductions.

26
attacks on health care were reported in Sudan during the first eight months of 2026, resulting in 196 deaths and 327 injuries. This brings the total to 225 attacks since April 2023, resulting in 2,054 deaths and 817 injuries.

~19.5 million
people are experiencing acute food insecurity, with ~ 825,000 children under five severely malnourished during 2026.

2,399
cholera cases and 215 deaths were reported by WHO across 15 localities in six states from May to August 2026.

8.6 million
internally displaced persons and 4.9 million returnees were recorded across Sudan by the end of July 2026.

Lebanon

334,353
internally displaced persons (IDPs) were recorded by IOM's Displacement Tracking Matrix (DTM) as of August 26, 2026.

4.3K
have been killed, as of August 24, 2026.

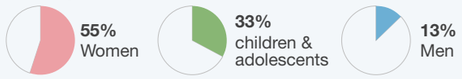
12.3K
have been injured, as of August 24, 2026.

551,635
health consultations were provided to IDPs, and 199,288 individuals received medication from Health Cluster partners since March 2, 2026.

EMPHNET's Efforts in Gaza | August 2026

235 outreach visits were conducted across Gaza, Deir Al-Balah, Khan Younis, and Rafah, reaching **22,665** individuals through health promotion and risk communication activities.

Demographics of reached individuals:



587 children under five and **1,079** pregnant and breastfeeding women were screened for malnutrition using MUAC. In addition, **1,079** pregnant and breastfeeding women benefited from Infant and Young Child Feeding (IYCF) interventions.

600 women and **1,000** children and adolescents benefited from Mental Health and Psychosocial Support (MHPSS) activities conducted in shelters and EMPHNET sites.

Community outreach was expanded through support for **17** Community Health Workers, enabling EMPHNET to increase field activities and reach more people across Gaza. Awareness sessions addressed key health concerns, including acute respiratory infections, acute watery diarrhea, hepatitis, hygiene, breastfeeding, NCDs, menstrual hygiene, first aid, food safety, and rodent-related risks.

A vaccination coverage survey was conducted in collaboration with the Ministry of Health, UNICEF, WHO, UNRWA, and PRCS to assess the proportion of children aged **0–36** months who are fully vaccinated according to the national immunization schedule.

References

- https://www.who.int/emergencies/disease-outbreak-news/item/2026-DON617
- https://www.ochaopt.org/content/humanitarian-situation-report-11-september-2026#preparing-health-services-and-displacement-sites-for-winter
- https://www.ochaopt.org/content/reported-impact-snapshot-gaza-strip-9-september-2026
- https://reliefweb.int/report/sudan/who-sudan-sudan-health-spotlight-august-2026
- https://reliefweb.int/report/sudan/sudan-situation-analysis-2482026-3082026
- https://reliefweb.int/attachments/b69659ed-46a5-48e4-ae2b-869421341131/OCHA_Lebanon_Flash_Update%20No%2051.pdf
- https://reliefweb.int/sites/default/files/attachments/bb/45/bb-45bcc4-2545-583d-8680-bfa2cf11b6ec.pdf