Editorial

Genomics in Action: Zambia's Path Toward Integrated Pathogen Surveillance

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Introduction

Genomic surveillance has become an increasingly important component of public health surveillance (1). The Africa Centres for Disease Control and Prevention (Africa CDC) calls on African Union Member States to integrate genomics into national public health systems and to develop sustainable approaches that respond to national priorities (2). Zambia's genomics agenda has moved deliberately and steadily from pathogen-specific and project-based sequencing towards an integrated and country-owned genomic surveillance programme supporting outbreak response, guided by the national pathogen genomics strategy launched in 2025 (3). Over the past several years, Zambia has strengthened sequencing capacity (4), developed a growing cadre of molecular biologists and bioinformaticians through training partnerships (3), and formed the Zambia Genomic Sequencing Consortium.

This progress was on full display at the 2nd Zambia Genomics Symposium, held on 27 and 28 August 2026 under the theme "Genomics in Action: Integrating AI and One Health for Enhanced Pathogen Surveillance in Zambia," which brought together researchers, clinicians, policymakers, and international partners including the World Health Organization (WHO), Food and Agriculture Organization (FAO), Japan International Cooperation Agency (JICA), United Kingdom Health Security Agency (UKHSA), and the Zambia Genomics Consortium. The symposium was a useful marker of how far the field has come, but it is one moment within a longer and broader effort. This editorial reflects on that broader trajectory: where Zambia's pathogen surveillance system stands, what is driving it forward, and what remains to close the gap between genomic discovery and public health action.

AI and One Health as the two ideas reshaping pathogen surveillance

AI and One Health are two ideas increasingly shaping how Zambia approaches pathogen surveillance, and both featured prominently in discussions at the symposium. Firstly, artificial intelligence is accelerating pathogen identification, resistance prediction, and real-time analysis at a scale unimaginable a decade ago (1,5). For Zambia, realising this potential depends on computational infrastructure, sound data governance, and trained personnel being in place, not on the technology alone. The second is the One Health framework, which recognises that human, animal, and environmental health are inseparable (2,3). Zambia's disease burden, from zoonotic spillover to antimicrobial resistance that co-evolves across clinical and environmental settings, cannot be understood through siloed surveillance. Programming that weaves human, animal, and environmental genomics into a single analytical narrative, as seen in recent research and in the symposium's own agenda, reflects a maturing and more honest approach to these challenges.

A Growing Evidence Base

Zambian scientists are generating an increasingly rich body of genomic research across wastewater metagenomics, antimicrobial resistance, viral genomics, and the microbiome. Wastewater surveillance has been shown to be an early warning tool for SARS-CoV-2 in Zambia (8), and genomic surveillance in Southern Province has characterised the SARS-CoV-2 variants of concern detected there (4) and machine learning applied to wastewater data is now being used to anticipate cholera outbreak risk before clinical cases accumulate. Genomic analysis of clinical isolates from Zambia has document-

ed the convergence of hypervirulence and multidrug resistance in Klebsiella pneumoniae (9), while whole genome sequencing has identified hypervirulent, sanitiser-resistant Listeria monocytogenes in the food supply chain. Viral genomics work, including the tracking of mpox co-circulation and dual-clade introduction, and the characterisation of seasonal influenza A viruses circulating between 2023 and 2025, is contributing directly to the global evidence base. This body of work, much of which was shared at the symposium alongside findings on cholera pathogenesis and child gut microbiome health, illustrates the breadth of what Zambian genomics now covers, well beyond any single meeting or event(6).

From Discovery to Surveillance: The Translation Gap

The defining challenge for Zambia's genomics agenda is not the generation of scientific evidence, which is increasingly strong, but its translation into routine surveillance, policy, and frontline action. This mirrors the experience across Africa, where limited sequencing infrastructure and shortages of trained genomics and bioinformatics personnel have constrained the use of genomics in public health practice (1,10). In Zambia, sequencing capacity remains concentrated in a handful of Lusaka-based institutions. The bioinformatics workforce is stretched across competing demands, data governance frameworks are still maturing, and policy processes do not always move at the speed genomic surveillance can now generate intelligence (2).

A Call to Action

Zambia's genomics journey, of which the recent symposium was one encouraging chapter, is a beginning rather than an end. No surveillance system outlasts the people who run it, and Zambia's emerging scientific workforce, including many early- and mid-career researchers who a decade ago would have travelled abroad for the training and equipment their work now requires locally, is the country's greatest genomic asset. Retaining and supporting these scientists is central to sustaining everything this field has built so far. To the Government of the Republic of Zambia, the call is to prioritise genomic surveillance within the national health security architecture, with dedicated budget lines and clear data governance. To research institutions and universities, the call is to integrate genomics into undergraduate and postgraduate curricula and to sustain postgraduate training. In particular, bioinformatics and related computational biology courses should be introduced at the undergraduate level, so that students build this foundation early rather than encountering it for the first time in postgraduate or professional training. To international partners, the call is to align funding with Zambia's own strategic priorities, including competitive research grants and equipment maintenance, supporting national ownership rather than project-by-project dependency. And to Zambian scientists, the call is to keep publishing, presenting, and collaborating, including through platforms such as The Health Press, so that genomic potential continues to translate into genomic impact for the health of all Zambians.

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