Imperial College London

DIGITAL DIAGNOSTICS FOR AFRICA

Lacewing Technology's Impact on Healthcare and Disease Surveillance

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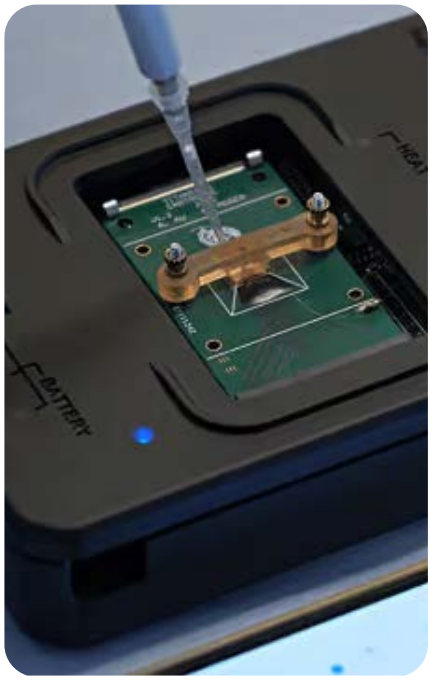

THE NEED

At least 50% of people in sub-Saharan Africa do not have access to essential health services, including easy access to accurate diagnostics.[1]

Children in sub-Saharan Africa are 14 times more likely to die before the age of 5 than those in developed regions, often from treatable infectious diseases.[2]

Affordable and accurate digital diagnostics offer immediate results at point-of-care and provide real-time disease health surveillance, even for remote, rural areas.

THE CONTEXT

Each year, about 10 million people die from infectious diseases.[3] The majority of them are in Africa, and most of them are children under the age of 5. Respiratory infections, HIV/AIDS, diarrhoea, malaria and tuberculosis are the main culprits. Many of these deaths could be prevented with early, appropriate treatment, but first healthcare providers need to accurately diagnose a patient's illness.

In February 2023, the World Health Assembly urged countries to establish national diagnostics strategies and routine data collection systems to rapidly identify disease outbreaks.[4] Most African countries lack the resources and infrastructure to diagnose and track diseases and outbreaks. While some populations can access state-of-the-art diagnostic facilities, the majority of people do not receive timely and accurate diagnoses.

Digital diagnostics offer an opportunity to leap-frog traditional, expensive technologies and offer portable, accurate diagnostics at point-of-care.

In 2020, a multidisciplinary team, led by Imperial College London and the University of Ghana, established the Digital Diagnostics for Africa Network. The network brings together 80 researchers, commercial partners, and not-for-profit organisations to tackle infectious diseases that primarily affect people in Africa.

The researchers use a diagnostic test known as Lacewing, which is a 'lab on a chip'. Its microchip can detect specific pathogens in a blood sample, and transmit high-quality findings to a smartphone via bluetooth. The device is portable, can be customised to the user, and generates accurate data in real-time, allowing for nationwide or even regional health surveillance.

> **Having different countries with different social contexts will help us really to provide a result that can be translated into policy everywhere in Africa.**
>
> Halidou Tinto, Regional Director of the Institut de Recherche en Sciences de la Santé, Burkina Faso

> **You can use digital diagnostics to reach under-served, remote communities, and bring them high-quality diagnostics. They're not limited by the bricks-and-mortar laboratory facilities that are quite scarce in Africa and to which only a small proportion of the population really have access.**
>
> Aubrey Cunnington, professor of paediatric infectious disease at Imperial College London, UK

SCIENCE AND TECH POTENTIAL

- Researchers at Imperial College London developed the novel Lacewing technology, and the institution has partnered with researchers from low- and middle-income African countries, among others, to determine how digital diagnostics can best be applied to their contexts. Partner countries include The Gambia, Burkina Faso, Ghana, Zambia, Sudan, and Kenya.
- The network funds 10 PhD candidates from different African countries, who are investigating the use cases of the technology in different contexts. Some are assessing the performance of the device, alongside its acceptability and usability, in different settings, such as hospitals or rural clinics. Others are looking at the best points to deploy them in the patient's journey and their use in healthcare systems as a whole.
- The test can be modified to detect different pathogens or parasites. It can detect malaria, but can also identify the different causes of fever in children – a common and often fatal problem in areas with a high number of disease-causing agents. Another version of the test can detect environmental pathogens in contaminated food or water sources.

BENEFITS

Growing market
The global digital diagnostics market is predicted to reach $1.8 billion by 2027, and is expected to continue growing.[5]

Accurate diagnosis
The technology has advantages over current PCR tests in that it is much more portable and does not rely on laboratory infrastructure, and can also incorporate decision support and troubleshooting.

Immediate health surveillance
The data is available in real-time, even in remote settings, allowing for nationwide health surveillance. Such information allows for immediate and targeted interventions. In the case of malaria, Lacewing can detect different species of the parasite and whether they have mutations that make them resistant to treatment.

Different diseases
The Lacewing technology can be easily adapted to identify a variety of disease-causing agents.

Context-relevant
By co-producing knowledge with African researchers, the project ensures that the technology will be relevant to and optimised for a variety of contexts. The interface is co-designed with users to ensure that it is accessible and something they can trust.

Scalability
With future investment, the technology could be rapidly deployed as its robust co-production and multi-country research makes it relevant to many settings.

Human capital
By supporting African students at African Universities, the team is developing much-needed capacity in several African countries, and creating future African leaders in the field of digital diagnostics.

Affordable, high-quality results
While more expensive than simple rapid diagnostic tests, Lacewing is more accurate, can test for a variety of diseases, and allows for real-time disease surveillance.

Future manufacturing capacity
It is possible to produce the devices locally so that African populations' health is not at the mercy of global supply chains.

> **The future is in digital diagnostics. Diagnosis is the most important thing for combating disease. If you cannot accurately diagnose disease, then you cannot accurately treat, which means that you cannot control the disease.**
>
> Gordon Awandare, Director of West African Center for Cell Biology of Infectious Pathogens, Ghana

ROUTE TO IMPACT

- **For patients:** The technology offers immediate diagnosis, which can reduce waiting times and speed up interventions. Swift responses to illness can save lives, particularly for children under 5, and reduce Africa's infectious disease burden. The portability of the device can give under-served communities high-quality diagnostics.
- **For healthcare practitioners:** Lacewing can speed up decision-making and help healthcare practitioners tackle patient backlogs. The technology can also be tailored to different levels of skill. It can offer a community health worker immediate decision-making support, while an experienced physician can investigate the specific pathogen mutation causing an illness.
- **For healthcare systems:** Governments can implement large-scale, high-quality diagnostic testing for a fraction of the cost of brick-and-mortar testing facilities. Immediate diagnosis can ensure that healthcare systems do not waste scarce resources and medicines by providing the incorrect treatment. Real-time data collection allows national and regional healthcare systems to track disease outbreaks, and identify and thus avoid future pandemics.

FUNDERS

The Digital Diagnostics for Africa Network was initially funded by the UKRI Global Challenge Research Challenge Fund. This provided a platform for the group to be awarded status as an NIHR Global Health Research Group to fund PhD students and research development.

NOTES

1. TThe Digital Diagnostics for Africa Network, 'The potential of digital molecular diagnostics for infectious diseases in sub-Saharan Africa', PLOS Digital Health, June 2022. https://journals.plos.org/digitalhealth/article?id=10.1371/journal.pdig.0000064
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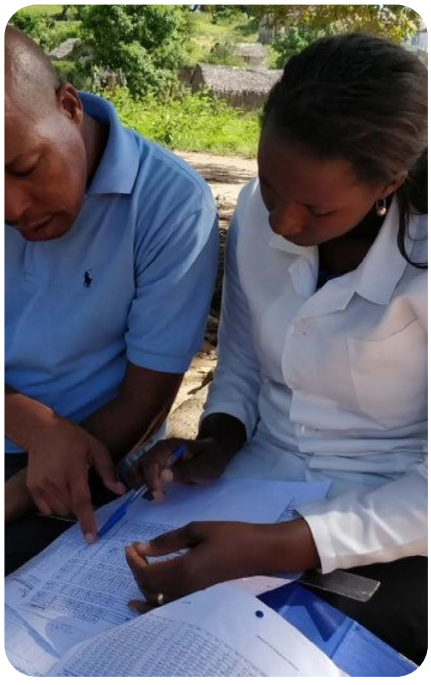

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The Global Development Hub brings together Imperial's community of global partners to develop, amplify and support research and education impact in Lower Middle Income Countries (LMICs) and Least Developed Countries (LDCs).

For more information:
Digital Diagnostics for Africa Network: www.digitaldiagnostics4africa.org
Global Development Hub: www.imperial.ac.uk/global-development-hub