# From equitable access to equitable innovation

Rethinking bioengineering for global health

**From equitable access to equitable innovation: rethinking bioengineering for global health**

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**Standfirst |**
What does global health equity mean? In bioengineering, 'equity' is often interpreted as global 'access' to technologies, thereby neglecting wider structural inequalities. Here, we suggest that concepts of equity need to be expanded to incorporate principles of equitable representation and recognition within the innovation ecosystem.

**[H1] Technological innovation and equity**

Bioengineers have helped to revolutionize the diagnostic landscape in global health. The application of microfluidics, biomedical sensing and genetic engineering to the development of infrastructure-free diagnostic tests that require minimal expertise to operate, are robust and endurable, and cost little to manufacture, have made it possible to test for a wide range of diseases in settings outside the laboratory. Nonetheless, gross inequities in access to diagnostics persist. Around half the world's population still lack access to basic diagnostic tests[1]. In response to this challenge, the bioengineering community has often focused on technological innovation, aiming to advance miniaturization, improve device connectivity, and reduce trade-offs between accessibility and accuracy. These advances in engineering are valuable, but the question remains whether technological innovation can achieve global health equity on its own. In this Comment, we argue that the answer depends on how equity is defined.

Drawing from approaches in social anthropology that explore underpinning conceptual frameworks and value systems[2], we suggest that the meaning of global health equity is not stable but fluid and contested. For example, framings of equity as access to diagnostic technologies have recently expanded to incorporate models of inclusive design and localized manufacturing. Nonetheless, the access agenda in global health diagnostics remains wedded to a narrow focus on the unequal distribution of biomedical technologies. Building on calls for 'epistemic justice' in global health, which highlight historical inequities in the production of global health knowledge[3],

we propose opportunities for bioengineering to contribute to improved representation and recognition of scientists and engineers working in low- and middle-income countries within the global health innovation ecosystem.

**[H1] Equitable access to biomedical technologies**

Concerns about equitable access to biomedical technologies in global health can be traced to the widespread outrage that emerged around the global community's failure to address the HIV epidemic in Africa in the late 1990s and early 2000s. The lack of availability of antiretroviral treatment in African countries resulted in significant mortality, while HIV-positive patients in North America and Europe experienced improved life expectancy with access to this treatment[4]. Campaigns to recognize access to affordable treatment as a human right led to reduced treatment costs and increased international funding for technology-driven infectious disease programmes, making the distribution of accessible and affordable technologies, from bed-nets to drugs to vaccines, the chief measure of progress in global health.

Efforts to raise awareness of the crucial role of diagnostic testing in addressing global health challenges have framed equity in a similar way, as an issue of equal access to diagnostic technologies[1,5]. In bioengineering, these efforts have resulted in improvements in the affordability, accessibility and accuracy of tests[6.] However, it is essential to reflect on the limitations inherent in framing global health equity solely as equal access to life-saving technologies.

The Covid-19 pandemic exposed some of these limitations by highlighting the reliance on the import of diagnostic products from abroad to improve diagnostic access in Africa. As global demand for near and point-of-care testing technologies surged, African countries were effectively locked out of the market due to distance from manufacturing sites and limited buying power [7]. The establishment of local diagnostic (and pharmaceutical) manufacturing capacity, long neglected in global health, has rapidly become a priority for African governments, international organisations, such as the Africa Centres for Disease Control and Prevention (CDC), and global health funders, such as the African Development Bank and the Bill and Melinda Gates Foundation. Calls for frugal innovation[8] and the democratization of manufacturing[9] suggest that devices should be developed from local materials and made open access for use and production, by anyone, anywhere.

These debates demonstrate that ideas about health equity and the role of bioengineering in global health are contested and changeable. From an anthropological perspective, however, the recent attention to the location of manufacturing for global health products represents an expansion of the global access agenda rather than a fundamental rethink of its underlying principles. A focus on how bioengineers can contribute to local manufacturing solutions still frames the problem as that of unequal access to end-products. This is arguably at the cost of alternative models of justice and equity that draw attention to social inequalities within the global health innovation ecosystem.

## [H1] Equitable representation in research and development

The focus on access in global health has not gone uncontested in bioengineering. If diagnostics are designed and developed in research laboratories far from the point of use, even with the best intentions of their designers, they can end up failing to meet user-needs. Recognizing these challenges has led to more inclusive design processes that are user-led, human-centred and entail co-design methodologies, with some notable successes in improving the impact of diagnostic technologies, for example the use of stakeholder engagement with prototypes of a sickle cell diagnostic tool in Zambia to effectively determine viable use cases for the device [10] Bioengineers increasingly pursue interdisciplinary collaboration with social scientists who can provide insight to contexts of use and understanding of complex health system dynamics[10].

Inclusive design offers the promise of greater representation of target communities within the innovation process. Nonetheless, the primary agenda remains designing better and more appropriate technologies to improve diagnostic access, rather than striving for equitable representation in the innovation process itself. Innovation and knowledge production often remain centered around engineers and entrepreneurs in high-income countries, who may or may not include users from low- and middle-income countries in their research and development processes.

The model of equity as fair distribution of technology takes fundamental inequalities within the global health innovation ecosystem for granted and ignores the historical and ongoing social and racial injustices producing them. Decolonizing global health demands that we address the structural conditions of global health research, including questions about who funds, produces and distributes knowledge[3]. Applying this framework to bioengineering requires reimagining equity beyond the paradigm of access and end-user involvement, and addressing the urgent need for equitable representation of scientists and engineers from low- and middle-income countries within the global innovation process.

The import-bias inherent within access-based models of diagnostic equity also conceals diagnostic innovation that is already happening in low- and middle-income countries. A workshop at Ashesi University organized by the Global Frugal Diagnostics Network invited bioengineers from across Africa to explore possibilities for Africa-led diagnostic innovation (**Fig. 1**). The participants included Laud Anthony Basing, the CEO of the Ghana-based diagnostics developer and manufacturer, INCAS Global Ltd., and Miskai Wayengera, a Uganda-based developer of a rapid diagnostic test for Ebola. The workshop drew attention to advances in bioengineering that are already taking place across Africa, as well as highlighting the need for further action to allow African scientists and entrepreneurs to succeed in a globalised industry.

## [H1] Representation, recognition and access

From a social justice perspective, addressing diagnostic equity involves asking what can be done to ensure that bioengineers around the globe are supported and resourced to contribute to global diagnostic solutions. Some suggestions for how the innovation ecosystem can be restructured to

achieve this, from regulatory harmonization to import duty waivers, have already been proposed but more bioengineers need to join this conversation.

Expanding concepts of equity to include equitable representation and recognition is fundamental to improve access to technology. Greater investment in bioengineering in low- and middle-income countries can challenge current epistemic and innovation frameworks and foster diagnostic solutions that better meet needs at the point of use. Representation, recognition and access are not mutually exclusive concepts. Indeed, access to material resources is crucial to the research capacity of bioengineers. Heeding the call of critical scholars of global health, it is time to recognize that global health equity cannot be achieved through the engineering of biomedical technologies alone; it also requires that we engineer equitable relationships within the innovation process.

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INCAS Global Ltd: http://incasglobal.com

Rapid diagnostic test for Ebola: https://qz.com/africa/523703/a-ugandan-scientist-found-a-way-to-detect-ebola-in-five-minutes-but-couldnt-get-funding
Localisation of Medical Manufacturing in Africa: https://www.iej.org.za/localisation-of-medical-manufacturing-in-africa/
The quest for Africa's diagnostic self sufficiency: https://speakingofmedicine.plos.org/2024/01/12/the-quest-for-africas-diagnostic-self-sufficiency/

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**Competing interests statement**

The authors declare no competing interests.

**Author contributions**

A.S., M.K.K., and Z.N. conceptualized the initial article. A.S. researched and wrote the first draft. M.K.K. and Z.N. researched, edited and wrote subsequent drafts.

**Figure 1. Workshop at Ashesi University organized by the Global Frugal Diagnostics Network**.