



Webinar 'Artificial Intelligence and Public Health'

November 18, 2024 – 2pm CET

PANELISTS

The application of AI in
Mathematical modeling for public
health interventions



Mr Abel W. Walekhwa
Director, IDEMU Mathematical
Modeling Unit,
Uganda

Application of AI in Infectious
Disease Surveillance and Early
Warning in China



Prof. Zhihang Peng
Deputy Director of Information
Center, Chinese Center for
Disease Control and Prevention,
China

AI and Global Health
Inequality



Dr. Homoud Algarni
Global Health Senior Expert,
Public Health Authority,
Saudi Arabia

MODERATED BY



Dr. Muhannad Sulaiman Aloraini
Public Health Academy Director, Public Health
Authority, Chair of the IANPHI Asia Network,
Saudi Arabia

Public Health Institutes of the World



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The application of AI in Mathematical modeling for public health interventions

The Application of AI in Mathematical Modeling for Public Health Interventions

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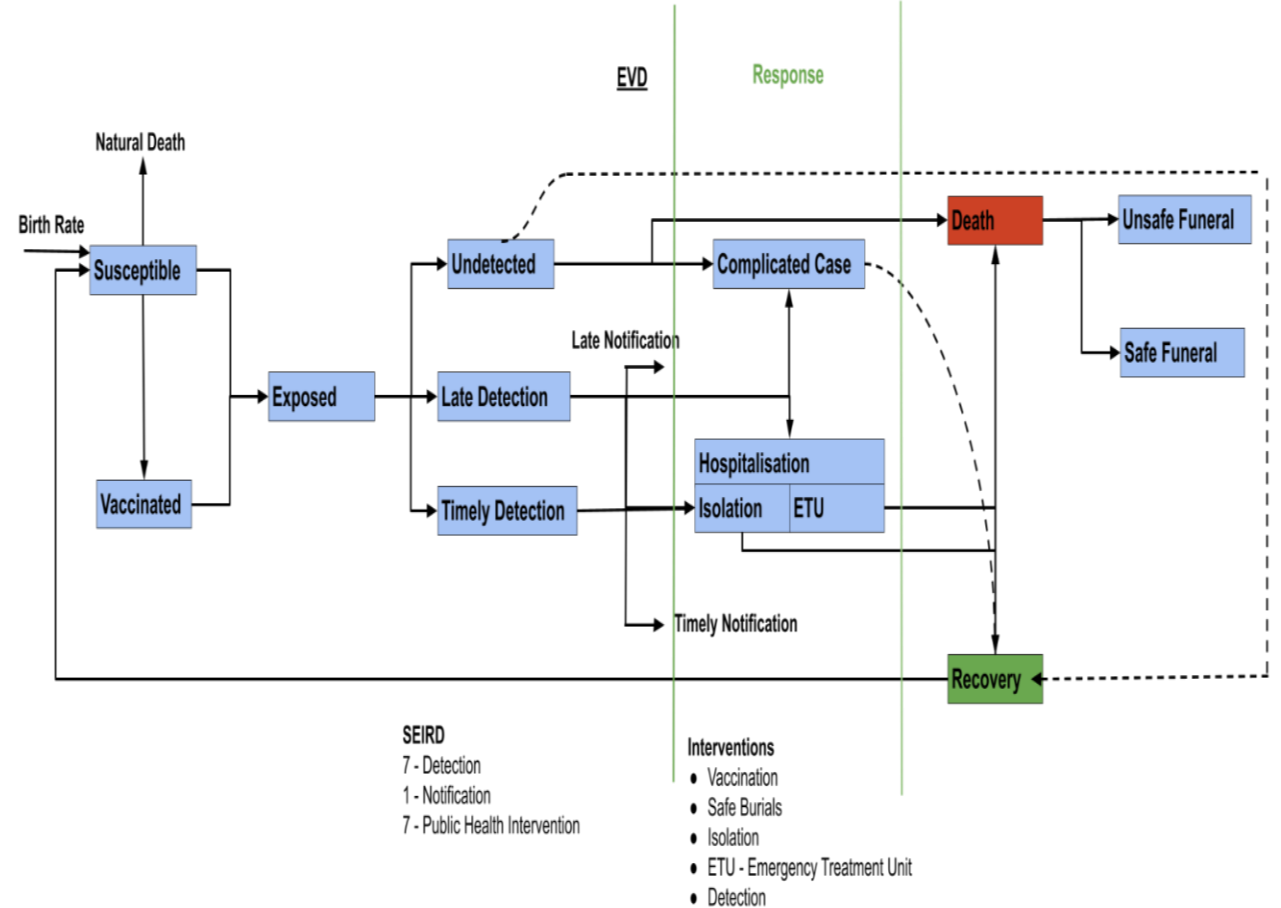
Definitions

• Mathematical Modeling:

Part of applied maths to study complex system/behavioral through predictions

Public Health Interventions:

Planned action/policy/effort aimed at protecting lives of the population (vaccination, isolation, quarantine etc)



Mathematical Models for Public Health Interventions

Periodicity of the HIV/AIDS Epidemic in a Mathematical Model that Incorporates Complacency

Livingstone Luboobi

Am. J. Infect. Dis., 1 (1):55-60, 2005

be necessary given the advances in medical interventions and in changes in medical seeking behaviours for persons living with HIV/AIDS.

MODEL EQUATIONS

From the descriptions and assumptions on the dynamics of the epidemic made above, the following are the model equations.

$$\left. \begin{aligned} \frac{dS}{dt} &= \Lambda(t) - \eta(A) \frac{SI}{N} - \mu S \\ \frac{dI}{dt} &= \eta(A) \frac{SI}{N} - (v + \mu) I \\ \frac{dA}{dt} &= vI - (\sigma + \mu) A \end{aligned} \right\}$$

ANALYSIS OF THE MODEL

But

$$I^* = \frac{\sigma + \mu}{v} A^* = \frac{\sigma + \mu}{v} \eta^{-1}(v + \mu)$$

Hence, for sufficiently large t_A , for all $t > t_A$,

$$|I(t) - I(t_A)| < \frac{\sigma + \mu}{v} \varepsilon_1 = \varepsilon_2$$

Choosing $\varepsilon_A = \varepsilon_2$ since $\varepsilon_2 > \varepsilon_2$ ends the proof for the first part.

From (2),

$$\frac{S}{S + I^*} - \frac{v + \mu}{\eta(A^*)} = 0, \text{ or } S = (S + I^*) \frac{v + \mu}{\eta(A^*)}$$

Simplifying gives

$$S = \frac{(v + \mu) I^*}{\eta(A^*) - (v + \mu)}$$

Research Article

[Epidemiology and Global Health, Medicine](#)

Mathematical modeling of the West Africa Ebola epidemic

Jean-Paul Chretien , Steven Riley, Dylan B George

Division of Integrated Biosurveillance, Armed Forces Health Surveillance Center, United States; School of Public Health, Imperial College London, United Kingdom; Biomedical Advanced Research and Development Authority, United States

Dec 8, 2015 • <https://doi.org/10.7554/eLife.09186>  

Computational and Mathematical Methods in Medicine

Research Article |  [Open Access](#) |  

A Mathematical Model of COVID-19 Pandemic: A Case Study of Bangkok, Thailand

Pakwan Riyapan , Sherif Eneye Shuaib, Arthit Intarasit

First published: 31 March 2021 | <https://doi.org/10.1155/2021/6664483> | Citations: 49

'[ejournals@cambridge](#) - find full text'

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Artificial Intelligence and Mathematical Modeling

- A branch of computer science that has numerical methods, language theory, programming systems, and hardware systems.
- **Key words:** Natural language processing, robotics, machine learning, deep learning, virtual reality, ChatGPT



Do we need AI for Mathematical Modeling?

- Provide high-level mechanisms for implementing **numerical models and solutions**
- Cleaner, easier to write, and more adaptable **computational mechanics codes.**
- A variety of algorithms for heuristic search, planning, **geometric reasoning, Interpretation**
- Effective and rigorous mechanisms for addressing problems (*shape description, and transformation, and constraint-based model representation.*)

National Academies Press; Washington DC

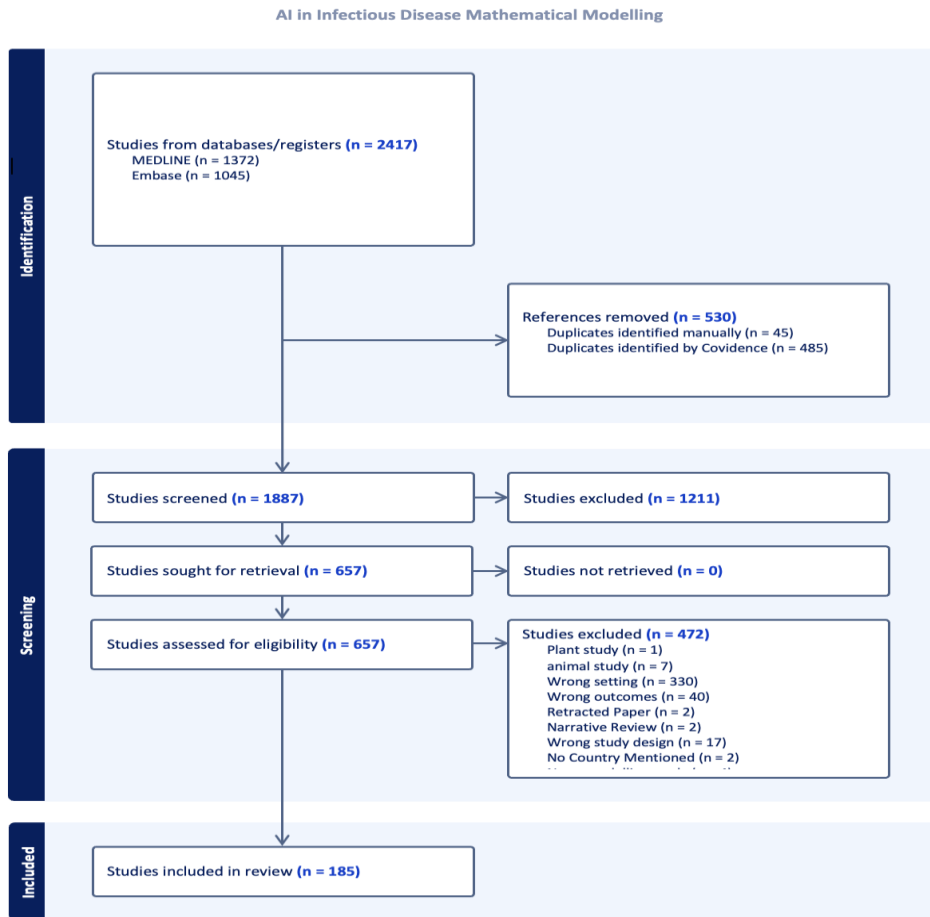


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Studies on AI for Mathematical Modeling?



My other records

These are records that have either been published or rejected and are not currently being worked on.

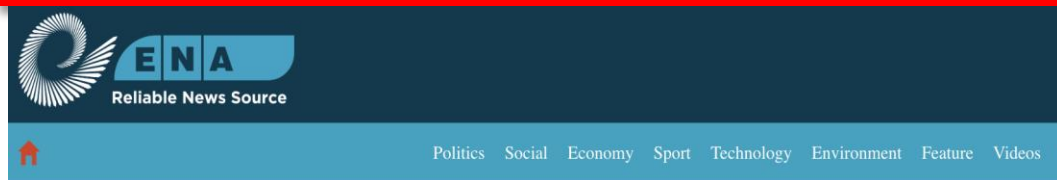
ID	Title	Status	Last edited
CRD42023464487	Advancing the Application of Artificial Intelligence for Public Health Mathematical modeling in Low and Middle Income Countries (1st January 1956-31st July 2023): a systematic review	Registered	27/10/2023

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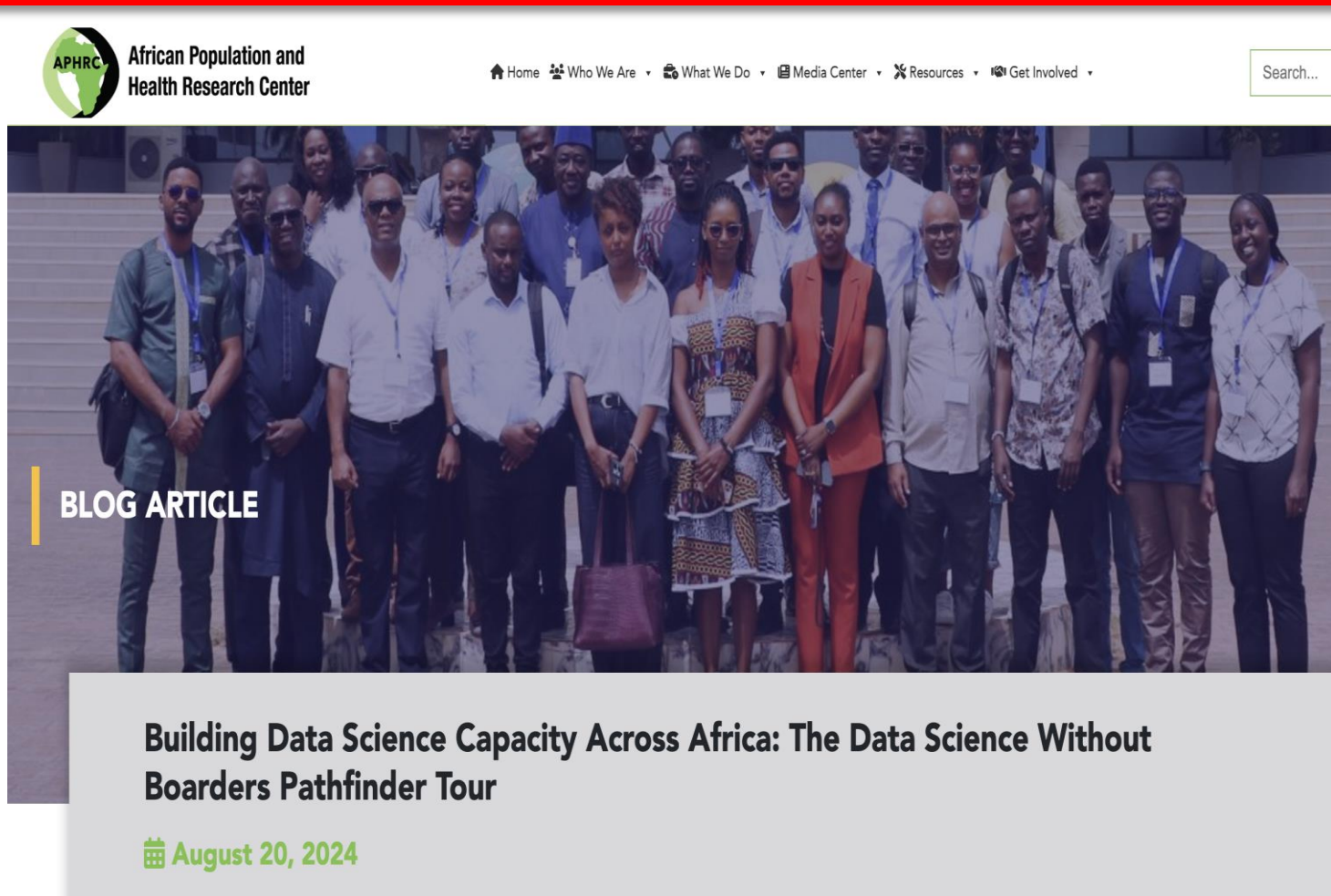
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Urgent need for Capacity building for AI tools for Mathematical Modeling?



New Data Science Project Launched to Transform Africa's Data Landscape



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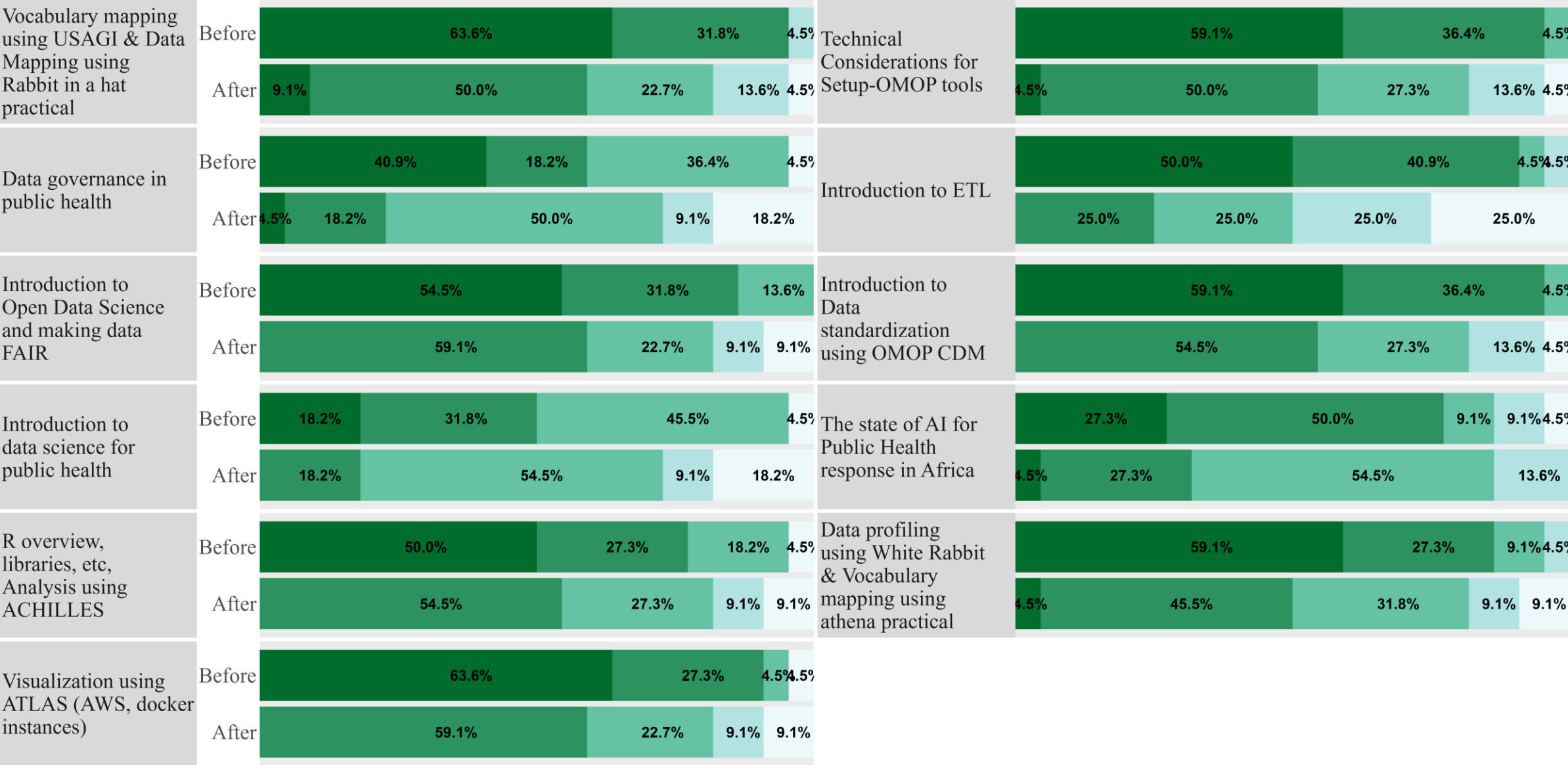
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Knowledge Improvement (%) Before and After Training



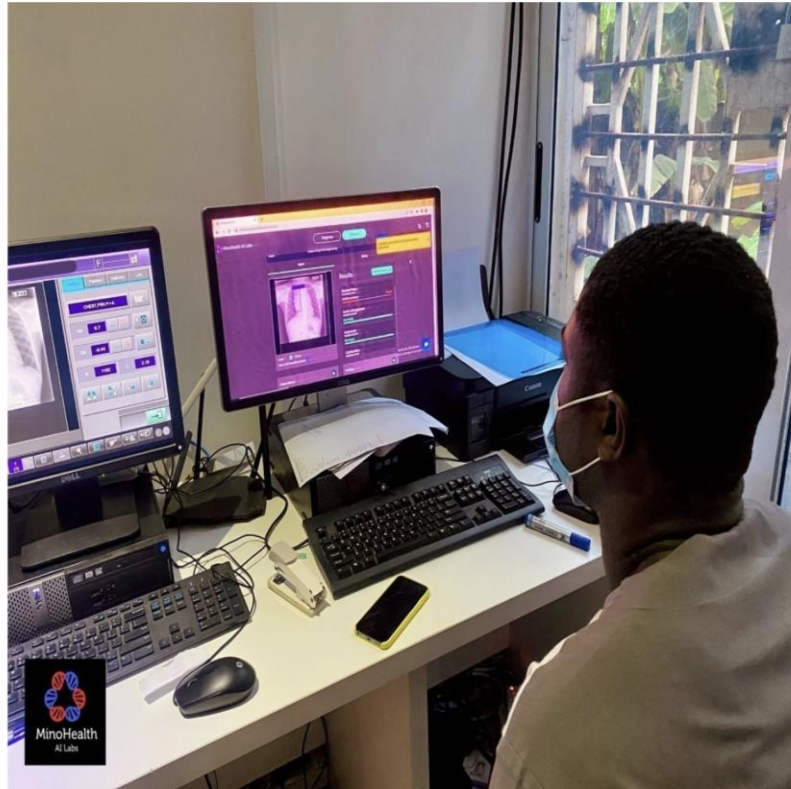
Knowledge Level ■ Novice ■ Beginner ■ Competent ■ Proficient ■ Expert

Knowledge Improvement (%) Before and After Training



Knowledge Level ■ Novice ■ Beginner ■ Competent ■ Proficient ■ Expert

Funding for Capacity building for AI tools for Mathematical Modeling?



Catalyzing Equitable Artificial Intelligence (AI) Use

Darlington Akogo of MinoHealth AI Labs in Ghana will leverage a multimodal Large Language Model (LLM) to generate accurate and comprehensive medical reports based on the analysis of medical images to reduce the need for manual reports and enhance diagnostic capabilities for radiologists and clinicians.

[Learn About The Award →](#)

Challenge

[Catalyzing Equitable Artificial Intelligence \(AI\) Use](#)

CEPI

Call for Proposals

30/09/2024

Implementing Partners for the Global South
Leaders in Epidemic Analytics and Response
Network (GS LEARN)

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Funding for Capacity building for AI tools for Mathematical Modeling?

JOURNAL ARTICLE

Artificial intelligence-enhanced biosurveillance for antimicrobial resistance in sub-Saharan Africa

Innocent Ayesiga , Michael Oppong Yeboah, Lenz Nwachinemere Okoro, Eneh Nchiek Edet, Jonathan Mawutor Gmanyami, Ahgu Ovyo, Lorna Atimango, Bulus Naya Gadzama, Emilly Kembabazi, Pius Atwau

International Health, ihae081, <https://doi.org/10.1093/inthealth/ihae081>

Published: 15 November 2024 **Article history** ▼

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Uganda Launches AI Health Lab at Makerere University

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Call to Action

- Develop AI policies to regulate and guide (Ethical aspects, Equity)
- Invest in Digitalization of Health records and embrace AI tools
- Invest in Data science infrastructure across Africa and Asia
- Have Data Sharing frameworks to enable Data Access and use
- Build Capacity in Mathematical Modeling across Africa and Asia

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