



## Smart Crawlers for Infectious Disease Modelling: Automating Data Acquisition in the Digital Age

Prof Dephney Mathebula-Periola (University of Fort Hare)

Monday, 15 June 2026 | 16h00–17h00 SAST

### HOW TO ATTEND:

#### In person (main venue):

- Road House Cinema (Neelsie) Stellenbosch University

#### Watch at satellite venues:

- Room P215, 2nd Floor Physics Building University of the Witwatersrand
- Seminar Room K310 Physics Building G5 North-West University

#### Online (live stream)

--- Please note, a recording of the lecture will be published on the NITheCS YouTube channel following the event ---

### ABSTRACT

Mathematical modelling of infectious diseases depends on timely and high-quality data, yet current data acquisition processes remain largely manual, slow, and inefficient. This results in two major challenges: data inaccessibility (due to restrictions or delays) and data redundancy (unused or irrelevant data). Both weaken research efficiency and model reliability.

To address this, the study introduces Intelligent Interactive Persistent Crawlers (IIPCs), autonomous, cognitive agents designed to continuously collect relevant epidemiological data from global digital sources. These crawlers operate in both automated and human-assisted modes, allowing flexibility and resilience when encountering complex data access issues.

A key contribution is the development of two performance metrics: Data Acquisition Efficiency (DAqE), which measures how effectively required data is obtained, and Data Analytics Efficiency (DAnE), which assesses how efficiently the data is processed. Simulation results show that crawler-based systems significantly outperform traditional manual methods, with a hybrid human–crawler approach achieving the highest efficiency and robustness, even under degraded system conditions.

In real-world terms, this framework enables continuous, real-time data integration into disease models, supporting faster, more accurate decision-making for public health interventions such as vaccination strategies and treatment allocation. Overall, the study demonstrates that integrating intelligent crawlers into epidemiological workflows can substantially improve data pipelines and advance digital epidemiology for more responsive and effective disease control, elimination, and eradication.

### BIOGRAPHY

Prof Dephney Mathebula-Periola is a Full Professor of Mathematics at the University of Fort Hare. She earned her PhD in Mathematics from the University of Venda in 2018, becoming the first South African to do so at that institution.

She holds an MSc and BSc Honours in Mathematics from Stellenbosch University, as well as a BSc Honours and BSc degree in Mathematics and Statistics from the University of Venda. She began her career at the University of Venda as a tutor and lecturer, later becoming a Senior Lecturer. She then served as an Associate Professor at the University of South Africa before taking up her current position in 2025. Her research focuses on mathematical modelling of infectious diseases, including malaria, influenza, and COVID-19.

She is a NITheCS Associate and a Fellow of the Institute of Mathematics and its Applications (UK). She was named one of Africa's Top 100 Career Women in 2024 and received the *Mail & Guardian* Power of Women Award in 2025. She is also passionate about mentoring young people in STEM.



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