

# PROCEEDINGS

## 2<sup>nd</sup> National Symposium and Workshop on Mathematical Modelling and Health Economics Research to Guide Decision-Making for Tuberculosis Control in South Africa

3 June 2024

In-person at The Edward (149 OR Tambo Parade, North Beach, Durban) and Online



THINKTANK



health

Department:  
Health  
REPUBLIC OF SOUTH AFRICA

By

Epidemiology Modelling and Health Economic Task Team  
Mmamapudi Kubjane, Erika Mohr-Holland & Don Mudzengi

## Table of Contents

<b>PROCEEDINGS</b> .....	0
<b>2<sup>nd</sup> National Symposium and Workshop on Mathematical Modelling and Health Economics Research to Guide Decision-Making for Tuberculosis Control in South Africa</b> .....	0
<b>Summary</b> .....	2
<b>Key lessons</b> .....	3
<b>Acknowledgements</b> .....	3
<b>Rationale &amp; Aims</b> .....	4
<b>Proceedings</b> .....	6
<b>Part 1: Introduction to Mathematical Modelling and Health Economics</b> .....	6
<b>Part 2: Ongoing TB Epidemiological, Implementation and Costing Studies in South Africa</b> .....	7
2A) Keynote address .....	7
2B) Presentations by South African Institutions/Organisations leading TB Epidemiology, Implementation and Costing Research that informs Mathematical Modelling Studies .....	7
<b>Part 3: Updates and Showcase of Modelling and Health Economics Initiatives in South Africa</b> .....	10
<b>Recommendations and the way forward</b> .....	11
<b>Speaker biographs</b> .....	13
<b>Links to resources</b> .....	17
I. Link to presented slides.....	17
II. Links to referenced mathematical modelling courses led by the South African Centre for Epidemiological Modelling and Analysis.....	17
III. Links to other important documents .....	17
<b>Appendices</b> .....	18
1. Agenda (amended) .....	18

## Summary

The 2<sup>nd</sup> National Symposium and Workshop on Mathematical Modelling and Health Economics Research to Guide Decision Making for Tuberculosis Control in South Africa was held on 3<sup>rd</sup> June 2024, in person at The Edward Hotel (149 OR Tambo Parade, North Beach, Durban), with a hybrid option for online attendance. The workshop and symposium were held a day before the 8<sup>th</sup> South African TB Conference which also took place in Durban from 4<sup>th</sup> to 7<sup>th</sup> June 2024.

The symposium had 35 and 30-40 in person and online attendees, respectively. Attendees represented the national TB programme and provincial/municipal departments of health, local and international academic institutions, non-governmental organisations, civil society representatives, and TB advocates.

The meeting was chaired by Mrs Erika Mohr-Holland and opened by TB Think Tank head of Secretariat, Dr Priashni Subreyan. The programme was split into three sessions. The first included presentations that introduced Mathematical Modelling (Dr. Cari Van Schalkwyk) and key concepts in Health Economics (Mr. Don Mudzengi). Concluding this first session was a presentation on the role of Health Economics and Mathematical Modelling in the context of National Strategic Planning, the process of developing a South African-led TB investment case, and the preliminary findings from this work (Prof. Gesine Myer-Rath).

The second session aimed to provide an update on ongoing TB epidemiological research and implementation and costing studies that inform transmission models and economic evaluations. The session was opened by Dr. Pren Naidoo, who gave a keynote address on South Africa's efforts in fighting TB and priorities for Ending TB. The presentations were as follows: updates on TB National TB Epidemiology and progress in implementing the National TB Programme's Strategic Plan (NTP-SP) and TB Recovery Plans (Mr. Hlengani Mathema); updates on TB preventative therapy implementation studies and challenges (Prof. Violet Chihota); updates on diagnostic pipelines and tools recommended by the World Health Organisation (WHO) and the Foundation for Innovative New Diagnostics (FIND) (Dr. Kavindhran Velen); methods for estimating the burden of TB and TB meningitis in children (Dr. Karen du Preez); updates on implementation studies on Targeted Universal TB Testing (TUTT) and studies looking to expand TUTT (Prof. Neil Martinson).

The third session aimed to showcase and give updates on ongoing South African-led and international initiatives in mathematical modelling and health economics initiatives for South Africa. The first talk included a presentation on one of the South African-led TB modelling initiatives, Thembisa version 2.0 (Prof. Leigh Johnson), highlighting some of the key changes to the model estimates and calibration to newer and more recent data, with highlights of

prospective plans to include provincial-level estimates and paediatric TB. The second talk in this session was on the cost of South African TB interventions and an economic evaluation of the new shorter regimens containing bedaquiline, pretomanid and linezolid (BPaL) for drug-resistant TB, considering costs from both the perspective of the patient and provider (Prof Denise Evans).

### Key lessons

- The TB investment case was a massive body of work which largely influenced the interventions included in the National TB Programme Strategic Plan (NTP-SP) and the National Strategic Plan for HIV, TB, and STIs (NSP) and can be utilised by provincial and municipal departments to better understand the impact and cost-effectiveness associated with these interventions.
- Support for modelling is available through the South African Centre for Epidemiological Modelling and Analysis (SACEMA), which host annual workshops to provide modelling capacity building.
- Mathematical modelling initiatives are limited by the available programmatic data and therefore there remain some gaps in the ability of the data from modelling to inform policy, especially at the provincial level.
- It is crucial to build and maintain relationships between mathematical modellers and TB intervention implementation scientists who focus on various aspects of TB, including prevention, diagnostics, treatment, management, and the associated costs of TB care.
- The BPaL-L regimen has huge cost-saving benefits for patients, which should assist in mitigating some of the catastrophic costs incurred by patients.

### Acknowledgements

We, the Epidemiology, Modelling, and Health Economics Task Team, extend our sincerest gratitude to the TB Think Tank under the leadership of Prof. Norbert Ndjeka and Prof. Fareed Abdullah, the Secretariat and the executive committee of the TB Think Tank for their support in organising this second follow-up National Symposium and Workshop on Mathematical Modelling and Health Economics Research for Tuberculosis Control in South Africa. Additionally, we acknowledge with gratitude the funders of the TB Think Tank whose support made this meeting possible. Secondly, we would like to express special thanks to all our speakers who, within a short time frame, generously availed themselves and shared their expertise. Last but not least, we thank every online and in-person participant who contributed to the rich discussions.

## Rationale & Aims

The first ever TB-focussed mathematical modelling symposium in South Africa, entitled “Mathematical Modelling Research to guide decision making for TB control” took place on the 27 & 28 of January 2020 in Stellenbosch. This was a joint initiative organised by the South African Medical Research Council (SAMRC), the South African Centre for Epidemiological Modelling and Analysis (SACEMA), the Centre for Infectious Disease and Epidemiology Research (CIDER), Desmond Tutu TB Centre, the National TB Think Tank, and the National Department of Health (NDoH). The key aims of this symposium were to: (i) highlight current research priorities in the fight against TB and opportunities for TB modelling research, (ii) provide an overview of completed and ongoing TB modelling research and initiatives, and (iii) discuss opportunities for networking and capacity building to strengthen collaborative TB modelling research in South Africa. The key outputs of this symposium are summarized in the proceedings document, with one of the key developments being the formation of the Epidemiology Modelling, and Health Economics (EMHE) Task Team embedded within the South African national TB Think Tank. While this symposium was well-attended, representation was mostly among academic stakeholders rather than those involved in TB programme oversight nationally and provincially. Therefore, a need to increase collaborative engagements with TB programme managers was identified to further disseminate and workshop how modelling can be directly applied to guide the TB response in South Africa. As was also highlighted at the previous symposium, there is also need for the inclusion of health economics in the mathematical modelling of TB programmatic interventions.

The World Health Organizations (WHO's) End TB Strategy targets for 2035 include achieving a 95% decline in deaths due to TB and 90% reduction in TB incidence compared with 2015, and for 100% of persons with TB to have social protection, with the aim of 0% of TB affected households facing catastrophic costs. In alignment with the theme of the 2024 South African TB Conference: **Accelerating Progress to End TB**, the EMHE Task Team aims to support the use of South African epidemiological, mathematical modelling, and health economics data to answer questions of primary importance to TB prevention and control. Additionally, the team aims to showcase economic and health impact analyses of TB-related interventions and policies that will accelerate progress towards meeting the End TB Strategy targets.

As such, the EMHE Task Team of the TB Think Tank hosted a follow-up symposium, in which we sought to showcase the country's ongoing mathematical modelling and health economics work and highlight research priorities necessary to accelerate progress toward the end TB targets. Additionally, we sought to disseminate information on the utility of mathematical modelling and health economics analyses to build capacity for applying these findings to inform policy and practice regarding the TB response in South Africa.

The specific aims of the symposium and workshop were to:

- 1) Provide a basic introduction to mathematical modelling and health economics.
- 2) Showcase findings from TB modelling, health economics and epidemiology work being conducted in South Africa aligned to the five National TB Programme Strategic Plan (NTP-SP) pillars.
- 3) Highlight research priorities for accelerating progress toward END TB milestones.
- 4) Workshop on how findings from TB modelling and health economics analyses can be applied to policy and practice
- 5) Provide a pre-conference opportunity for networking between TB modellers, health economists and stakeholders from the TB programme

The modelling symposium and workshop were hosted on 3<sup>rd</sup> June 2024, a day before the SATB Conference, which took place in Durban from 4-7 June. We aimed to have a diverse representation of attendees, including academic stakeholders and those involved in the management of national and provincial TB programmes. As such, to make attendance accessible to all, there was an option for hybrid attendance. The findings from the Symposium are highlighted here within.

## Proceedings

### Part 1: Introduction to Mathematical Modelling and Health Economics

- **Dr. Cari van Schalkwyk, SACEMA, Stellenbosch University.** *Title: Simple introduction to tuberculosis mathematical modelling. Building modelling capacity in South Africa.* Dr van Schalkwyk introduced mathematical modelling and applied epidemiological modelling, highlighting its importance. The presentation showcased uses of mathematical models included estimation, prediction, planning and informing policy decisions, and evaluation interventions. She also emphasised the importance of calibrating to real-world scenarios and quality data to make models more meaningful and valuable. She also highlighted the role of SACEMA in leading trainings for mathematical modellers in the country. Such trainings include the Clinic on Meaningful Modelling of Epidemiological Data (<https://www.ici3d.org/mmed/>) and the Clinic on Dynamical Approaches to Infectious Disease Data (<https://www.ici3d.org/daidd/>).
- **Mr. Don Mudzengi, Aurum Institute.** *Title: Simple introduction to modelling economic evaluations of TB programme interventions.* Mr Mudzengi provided an overview of key concepts health economics, such as technical and allocative efficiency with illustrative examples of how these apply to TB programme interventions. Allocative efficiency or “*doing the right things*”, is concerned with directing and spending resources on interventions with the most public health impact—those that save the most lives, improve health outcomes, and deliver the highest value for the population. Technical efficiency, often described as ‘*doing things right*’ focuses on maximising outputs while using the least amount of resources. Mr Mudzengi also highlighted how integrating health economics concepts into mathematical models can enhance long-term planning by using current data to predict intervention cost-effectiveness, guide investments and maximise value through optimal allocative and technical efficiency.
- **Prof. Gesine Meyer-Rath, Health Economics and Epidemiology Research Office (HE<sup>2</sup>RO).** *Title: Utility of TB modelling and health economics in National TB Strategic Planning (SA TB Investment Case).* Prof Meyer-Rath presented on the use of TB epidemiological modelling and health economics in the context of national TB strategic planning and presented the process of leading the development of the South African TB Investment Case and some of the preliminary results of this work. She highlighted the ideal health decision-making planning and budgeting cycle related to work done at HE<sup>2</sup>RO to develop the TB Investment Case. The cycle starts with data and ends with new data. The cost and modelling work is based on updated cost and epidemiological data to optimise the allocative efficiency of the TB programme budget. This will

ultimately inform the national strategic planning and budgets (the National Strategic Plan for HIV, TB and STIs and the National TB Programme's Strategic Plan), provincial plans and budgets, and eventual implementation.

## Part 2: Ongoing TB Epidemiological, Implementation and Costing Studies in South Africa

### 2A) Keynote address

- **Dr. Pren Naidoo, Independent Consultant.** Keynote address: South Africa's efforts in fighting TB and priorities for Ending TB. In her keynote address, Dr Naidoo emphasised the significant progress made in South Africa in reducing TB incidence and mortality and highlighted the challenges that persist as the epidemic declines. Additionally, she noted that as the epidemic declines, the number needed to test before finding a TB patient will increase, demanding greater investment. She also noted the recent minimal impact of various interventions on TB mortality and the need to address this issue. Emphasis was placed on the crucial need for systematic screening in order to reduce incidence and mortality; however, selecting the optimal investment options remains complex. She highlighted how modelling provides critical insights into the impact of innovative tools like vaccines and diagnostics, allowing for a comparison of costs and effectiveness. She also suggested that understanding historical interventions informs future investments, although outcomes will vary based on model assumptions. She stressed the critical need to build confidence in modelling outputs and enhance literacy within South Africa's TB programme, which is essential for informed decision-making and budget planning. She closed by urging that it remains the responsibility of us and those involved in the TB response to motivate for the investment required to accelerate the impact on the epidemic and advocate for the endorsement of new tools (e.g. vaccines, cheaper diagnostics, shorter drug regimens) which modelling evidence shows will accelerate efforts to End TB.

### 2B) Presentations by South African Institutions/Organisations leading TB Epidemiology, Implementation and Costing Research that informs Mathematical Modelling Studies

- **Mr. Hlengani Mathema, TB Cluster, National Department of Health.** Title: South African TB Epidemiology and updates on the implementation of the TB Recovery Plans 2.0 (2023-2024), which is informed by the National Strategic Plan for HIV, TB and STIs (2023-2028) (NSP) and the National TB Programme's Strategic Plan (2023-2028) (NTP-SP) and the NTP-SP's five pillars: i) Communicate & Advocate, ii) Find & Link, iii) Treat & Retain, iv) Prevent & Prepare, v) Monitor & Assess.. The talk highlighted the performance of the TB Recovery Plan 2.0, some of which



included: a 12% increase in TB nucleic acid amplification tests (TB NAAT) in 2023; successful rollout of a 6-month regimen for drug-resistant TB (DR-TB) treatment – 879 patients initiated between Sep-Dec 2023; initiating 41 000 TB contacts on TB preventative treatment (23% of target). Moreover, developing an electronic medical register will improve access to quality TB data. Lastly, they presented the TB Recovery Plan 3.0 programme implementation targets. These included accelerating the implementation of Targeted Universal TB Testing among people living with HIV, recent TB contacts, and recovering from TB in the last two years; conducting 3 million TB NAATs; scaling up digital chest X-rays; conducting an assessment of urine LAM implementation; ensuring bedaquiline resistance testing of all people with confirmed DR-TB; improving linkage of people with TB to treatment using text messaging; strengthening adherence counselling (including risk assessments for people with TB); further scale-up of TB preventative treatment; and preparing the landscape for TB vaccines.

- **Prof. Violet Chihota, Aurum Institute.** *Title: TB Prevention: TB preventive treatment implementation research studies.* Prof Chihota highlighted the evidence from clinical trials showing the non-inferiority of a three-month weekly doses of rifapentine + isoniazid (3HP) to 6 months isoniazid-only, the non-inferiority of one-month daily HP vs 9-months of isoniazid, and the safety and better adherence outcomes of the shorter preventative regimens. The talk also highlighted the challenges in moving from evidence from clinical trials to implementation, including long delays from discovery to implementation and gaps in knowledge of scaling up implementation. A few implementation research studies were highlighted. The IMPAACT4TB project aims to expand access to 3HP for high-risk groups, including people living with HIV, in 12 low- and middle-income countries. The Opt4TPT study sought to optimise the delivery cascade for TB preventive treatment through the use digital technologies (EvriMED 1000 pill boxes) for measuring adherence. This work shows that as implementation research evidence on the scale-up of 3HP and other shorter regimens becomes available, modelling and economic evaluation analyses need to incorporate updated assumptions on the duration of protection given by shorter preventative treatment regimens, acceptance of new regimens, adherence, completion of treatment, and adverse events reported in programmatic settings.

- **Dr. Kavindhran Velen, Foundation for Innovative New Diagnostics (FIND).** Title: The Diagnostic Pipeline: What We Have to Look Forward To. Dr Velen highlighted the trade-off between clinical performance, accessibility and affordability for newer diagnostic and screening tools. It provided a comprehensive summary of the diagnostics pipeline, showing the many new dimensions of how TB could be diagnosed. These include low- and moderate-complexity nucleic acid amplification tests (NAATs), targeted next-generation sequencing (NGS), and the systematic screening pipeline. It also showed some of the promising results from tongue swab studies over the last year (2023). Dr. Velen also presented early results from some of the work conducted by Dr. *Andrew. Medina-Marino et al.*, where tongue swabs increased the diagnostic yield in household contacts in the Eastern Cape. This talk emphasised that new instruments and sampling strategies are promising to bring diagnostics closer to vulnerable populations, however, a trade-off in yield accuracy is to be expected, and the impact is unknown. Mathematical modelling and economic evaluation exercises need to explore the epidemiological impact and cost of these different trade-offs in the accuracy/performance of tools and community-level access.
- **Dr. Karen du Preez, Desmond Tutu TB Centre, Stellenbosch University.** Title: TB meningitis in children – global estimates, local health systems and COVID-19. Dr. du Preez focused on estimating the global TB meningitis (TBM) burden in children using a Bayesian model, integrating various data sources, including routinely available data on population estimates, TB and HIV prevalence, BCG coverage, TB notifications, and data from systematic reviews and meta-analyses. It highlighted the importance of early diagnosis and treatment of TBM, emphasising the need for diagnostic support and robust healthcare systems. Prevention strategies discussed included BCG vaccination (73% efficacy) and TB preventive treatment (63% effectiveness). Crucial needs included strengthening TBM surveillance and further research on costing and socio-behavioural impacts on affected communities.
- **Prof. Neil Martinson, Perinatal HIV Research Unit (PHRU), Witwatersrand University.** Title: Targeted Universal Testing for TB (TUTT) and TUTT-plus, Finding TB among Men, and Sub-clinical TB. Prof Martinson's talk focused on the various high-risk groups that could be prioritised in the implementation studies on closing the diagnostic gap. The identified risk groups for TB are many: men, geographical settings with high TB burdens, people living with HIV, miners, mining

communities, incarcerated individuals, pregnant people, smokers, substance users, undernourished persons, and people with diabetes, to name a few. However, the challenge is how to prioritise these populations and pragmatically implement interventions that focus on the most vulnerable. The talk also highlighted the ongoing implementation of studies focused on increasing testing and reaching various TB risk groups in South Africa: TUTT-Plus, which involves tongue swabs (and Xpert Ultra) to augment sputum collection; TUTTPT, which involves starting TPT at the time of ART initiation without waiting for TUTT result; optimisation and implementation of NEXAR - technology that provides significant PCR testing capacity; and Finding the Missing Men. Mathematical modelling with this level of detail, including different high-risk groups can play a role in assessing the potential impact of targeted interventions.

### **Part 3: Updates and Showcase of Modelling and Health Economics Initiatives in South Africa**

- **Prof. Leigh Johnson, Centre for Infectious Disease Epidemiology and Research (CIDER), University of Cape Town.** *Title: The Thembisa TB Model, version 2.0 Preliminary Results*. Prof Johnson focused on the estimates from a new version of the Thembisa TB Model. These model outputs are now available online to download on the Thembisa website (<https://www.thembisa.org/tuberculosis>). The estimates from the new model show higher overall TB incidence and prevalence figures compared to previous estimates, although TB prevalence among People Living with HIV have decreased due to incorporating new survey data that better reflects the relationship between HIV and TB prevalence. The Thembisa TB model is calibrated to several South African specific-data sources, which comes with complex challenges. The Thembisa TB model incidence and mortality estimates were very close to WHO estimates for 2022 and similar to the mortality estimates reported by the Institute for Health Metrics and Evaluation estimates (IHME), although TB incidence estimates were lower than reported by IHME. Prof Johnson explained that the IHME's approach gives less weight to TB notification data. Prospective work to be included in the Thembisa TB project include: developing provincial versions of the Thembisa TB model; adding a paediatric TB component to the model; modelling rifampicin-resistant and multidrug-resistant TB; and modelling TB vaccines.

- **Prof. Denise Evans, Health Economics and Epidemiology Research Office (HE2RO).** *Title: Health economic evaluation of BPaL for RR/MDR-TB treatment in South Africa.* Prof Evans started with a brief overview of evidence from the literature on the costs of the South African TB programme interventions, which has informed the costing component of the South African TB Investment Case. The talk focused on the updated guidelines and implementation of the DR-TB BPaL-L regimen. This 6-month regimen is now part of the TB Recovery Plan. The economic evaluation compared the BPaL-L 6-month regimen, the standard 9-12 months short all-oral regimen, and the standard 18-21 month long oral regimen and evaluated client and provider costs. It showed that the simplified regimen for DR-TB is cost saving to people with TB and reduces pill burden, and the shortened duration of treatment results in lower costs to the healthcare system due to fewer monthly follow-ups and a reduced need for lab-based treatment monitoring. The results also suggested that the BPaL-L cost is likely lower under programmatic conditions. These findings further support the rapid implementation of the regimen given the benefit it has in mitigating catastrophic costs incurred by people with TB.

### Recommendations and the way forward

- A need for modelling literacy was identified. Participants also identified a need for modellers to better communicate to programme managers and non-modellers what drives differences in model estimates from the different modelling studies.
- Participants shared a desire to maintain established relationships between mathematical modellers, provincial and national TB programme managers, and implementation scientists to facilitate data exchange and provide essential information for models. This includes data on intervention coverage, outcomes, costs, epidemic surveillance, and other relevant metrics.
  - Through relationships developed in the meeting, modellers mostly reach out directly to the relevant individuals for data requests, however, the EMHE Task Team will provide support or facilitate access where necessary.
- There is a need for capacity-building workshops directed at provincial-level TB programme managers for target setting and budget planning. There is an opportunity for the TB programme to learn from the HIV programme in running such workshops using the Thembisa HIV provincial-level model, and district-level model for HIV (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8454682/>).
  - The EMHE will follow up to ensure that this activity is facilitated in the future when provincial and district-level TB models become available.

- Modelling work needs to incorporate up-to-date empirical data on scaling up implementation of different interventions, e.g. TB preventative treatment - 3HP efficacy/protection.
- Holding the TB Symposium before the South African TB Conference and having a virtual option was welcomed and successful. The next symposium could be hosted the day prior to the 2026 TB Conference, with more forewarning to allow for more advanced planning.

## Speaker biographs

- **Mrs. Erika Mohr-Holland, City of Cape Town.** Mrs Mohr-Holland holds a Master's Degree in Public Health and Epidemiology and currently works as an Epidemiologist for the City of Cape Town, supporting the primary health care programme. With 11 years of experience in the South African TB programme, she chairs and co-chairs several epidemiological and clinical forums dedicated to the national TB response. Erika is an active member of TB Proof, a South African NGO committed to ending the TB epidemic by advocating for social equity, mobilizing resources, and reducing TB stigma. She is passionate about addressing gaps in the TB care cascade by focusing on the social determinants of health.
- **Dr. Priashni Subrayen, Aurum Institute.** Dr Subrayen is a qualified medical doctor with more than 15 years' experience working in public health in South Africa and abroad. After acquiring a formal business education, she developed a keen interest in systems thinking, process re-engineering and data analytics and management which has been her specialised area for the past ten years working in TB and HIV in South Africa. She is the current lead of the South African TB Think Tank Secretariat.
- **Dr. Cari van Schalkwyk, South African Centre for Epidemiological Modelling and Analysis (SACEMA), Stellenbosch University.** Dr van Schalkwyk is a senior researcher at the South African Centre for Epidemiological Modelling and Analysis (SACEMA) at the University of Stellenbosch. In recent years, her research has focused on the epidemiology of HIV, human papillomavirus (HPV), the synergies between these two viruses, the progression of HPV to cervical cancer and the impact of prevention of these diseases in South Africa. She has also done work on other infections of national priority in South Africa, such as COVID and TB. She holds a PhD in Epidemiology from the University of Cape Town, and a master's degree in Mathematical Statistics from the University of Stellenbosch. She is an executive faculty member of the International Clinics on Infectious Disease Dynamics and Data Program (ICI3D) and leads the secretariat of the UNAIDS Reference Group on Estimates, Modelling, and Projections (epidem.org).
- **Mr. Don Mudzengi, Aurum Institute**  
Mr Don Mudzengi is a Health Economist at the Aurum Institute with extensive experience in costing and economic evaluation of public health interventions. His research focuses on the economic evaluation of TB and HIV interventions and optimising resource allocation. He supported and co-led South Africa's first national TB patient costing survey and served as a Health Economist in the inaugural South

African TB Think Tank. Currently, he co-chairs its Epidemiology, Modelling, and Health Economics Task Team.

Mr Mudzengi has collaborated with prominent local and international researchers on TB and HIV, publishing work on patient costs, case detection, and resource allocation. His involvement in public health research spans multiple countries, focusing on TB preventive treatment, contact tracing, and new TB drugs. He is currently managing a large global clinical trial aimed at evaluating the safety and efficacy of a shorter TB drug regimen. Additionally, Mr Mudzengi is pursuing a PhD at the University of the Witwatersrand, where he is exploring the use of mobile health technologies to enhance TB contact tracing.

- **Prof. Gesine Meyer-Rath, Health Economics and Epidemiology Research Office (HE<sup>2</sup>RO).** Prof Meyer-Rath is a medical doctor and health economist working on the economics of infectious disease interventions in low- and middle-income settings. She is a Research Associate Professor in the School of Public Health of Boston University, US, and a Principal Researcher at HE<sup>2</sup>RO, Witwatersrand. Prof. Meyer-Rath's research focus lies on modelling methods for economic evaluation and translating research into recommendations for public policy, in particular for the HIV, TB and COVID-19 programmes of South Africa and other southern African countries.
- **Dr. Pren Naidoo, Independent Consultant.** Dr Naidoo (MChB, MBA, PhD) is a Public Health Management Consultant with deep experience of HIV/AIDS and TB Programmes. She previously managed the City of Cape Town TB and HIV programmes and established Multisectoral Action Teams and she leads Health Systems and Operational Research at the Desmond Tutu TB Centre. She has worked as a consultant with various national organisations and has supported the Bill and Melinda Gates Foundation's TB Delivery Strategy in South Africa since 2016. She has served on the NACOSA Board since 2009, was an advisory committee member of the Children's HIV/AIDS Network (CHAIN) and is a member of the South African TB Think Tank. Her areas of work interest include strategy and policy development; health programme implementation and management; project management; health systems innovation; implementation science and operational research; and data driven approaches to health systems strengthening.
- **Mr. Hlengani Mathema, TB Cluster, National Department of Health.** Mr Mathema is an infectious disease epidemiologist currently serving in the TB Control and Management Cluster within the National Department of Health, South Africa (seconded from The Aurum Institute). He has a record of working in academic, non-profit, and government spaces, with extensive experience supporting health systems

and services for the prevention, control, and management of infectious diseases, including epidemic preparedness and response. He is interested in the surveillance of TB, HIV, vaccine-preventable diseases, and notifiable medical conditions. He holds postgraduate qualifications in psychology, public health, and epidemiology.

- **Prof. Violet Chihota, Aurum Institute.** Prof. Chihota is a Chief Specialist Scientist at The Aurum Institute. She has over 15 years' experience in global health research in the fields of TB and TB/HIV co-infection. Her work has focused on the molecular epidemiology of drug-sensitive and drug-resistant TB, diagnosis of TB and linkage into care, post-diagnosis. Her current interests are in evaluating strategies to prevent TB in people living with HIV. She has joint appointments at University of Witwatersrand, School of Public Health, South Africa and Vanderbilt University, Division of Infectious Disease, Department of Medicine, USA.
- **Dr. Kavindhran Velen, Foundation for Innovative New Diagnostics (FIND).** Dr Velen is currently a Senior Scientist at FIND, responsible for bridging the gap between evidence generation and policy impact within the TB programme. This entails supporting the evaluation of new diagnostics/tools and identifying their optimal use-cases through operational research. Prior to his current role, he was a Specialist Scientist at the Aurum Institute with a specific focus on TB research and optimising case finding strategies. He has a combined 17 years of experience in public health and epidemiological research within the private, government and NGO space in various technical, research and management roles. He is an epidemiologist and medical microbiologist who holds a PhD from the University of Witwatersrand and a Master's in Public Health (Epidemiology and Biostatistics) from the University of Pretoria. He is a current member of the WHO regional greenlight committee (rGLC) for DR-TB (South-East Asia). He is co-chair of the Finding Missing People with TB task team of the South African TB Think Tank.
- **Dr. Karen du Preez, Desmond Tutu TB Centre, Stellenbosch University.** Dr. du Preez is a clinician with specialised training in Epidemiology and Biostatistics. She joined the Desmond Tutu TB Centre in 2008, and has considerable experience in operational, health-systems and implementation science research. Her specific research interests include epidemiological analyses of routine data, impact evaluation of health system strengthening interventions, spatial analyses and modelling to improve prevention, management, surveillance and disease estimates of childhood TB. Karen is passionate about improving child health in South Africa and globally, and committed to conduct high priority public health research. She is actively involved nationally and internationally to translate research into policy and practice.



- **Prof. Neil Martinson, Perinatal HIV Research Unit (PHRU), Witwatersrand University.** Prof. Martinson graduated at the University of the Witwatersrand in Johannesburg and then obtained a post-graduate qualification in family medicine a few years later. He has over 27 years of managerial and research experience in South Africa and is currently the executive director of the PHRU – a research unit of the University of the Witwatersrand - and an adjunct associate professor in the School of Medicine at Johns Hopkins University. His research work has focused on: preventing TB and measuring its often-fatal interactions with HIV; early case finding for TB in HIV-infected pregnant women and household contacts of people with TB; and aetiology of lung pathology in admitted adult patients. He has been the PI of several cluster and individually randomised trials and has designed and conducted multiple large prospective cohort studies including targeted universal testing for TB (TUTT) in adults attending primary health care clinics.
- **Prof. Leigh Johnson, Centre for Infectious Disease Epidemiology and Research (CIDER), University of Cape Town.** Prof. Johnson is an epidemiologist and modeller who works at the Centre for Infectious Disease Epidemiology and Research at the University of Cape Town. His work has focused mainly on developing models to assess the burden of HIV, TB and STIs in South Africa, and the impact of disease control programmes. He is the lead developer of the Thembisa model and the MicroCOSM model. He is co-chair of the UNAIDS Reference Group on Estimates, Modelling and Projections. He is also an executive committee member of the TB Modelling and Analysis Consortium and the HIV Modelling Consortium. He also serves as an editor of 'Infectious Disease Modelling' and 'Journal of the International AIDS Society'.
- **Prof. Denise Evans, Health Economics and Epidemiology Research Office (HE<sup>2</sup>RO).** Prof. Evans is a Principal Researcher at HE<sup>2</sup>RO, a division of the Wits Health Consortium, with more than 14 years of research experience focused on optimising HIV, TB, and drug-resistant TB treatment outcomes. She has a joint position in the Faculty of Health Sciences at the University of the Witwatersrand as an Associate Professor. She is currently the technical lead of the TB research area at HE<sup>2</sup>RO and has worked on several health economic evaluations of TB, including a budget impact analysis on managing multidrug-resistant TB in South Africa.
- **Dr. Mmamapudi Kubjane, Health Economics and Epidemiology Research Office (HE<sup>2</sup>RO).** Dr Kubjane is a South African epidemiologist and infectious disease modeller interested in modelling TB and the population-level impacts of interventions. More recently, she is interested in modelling interventions to address social determinants of TB, post-TB sequelae, and TB-associated catastrophic costs. She

currently works at HE<sup>2</sup>RO, conducting economic evaluations of TB programmatic interventions and supporting the development of the South African TB Investment Case. She is also an active member of the TB Think Tank, and serves as the chair of the Epidemiology, Modelling and Health Economics Task Team.

### Links to resources

- I. Link to presented slides
- II. Links to referenced mathematical modelling courses led by the South African Centre for Epidemiological Modelling and Analysis
  - Clinic on Meaningful Modelling of Epidemiological Data (<https://www.ici3d.org/mmed/>)
  - Clinic on Dynamical Approaches to Infectious Disease Data (<https://www.ici3d.org/daidd/>)
- III. Links to other important documents
  - 2017/2018 - 2019/2020 National AIDS Spending Assessment plus (NASA+) HIV and Tuberculosis Spending in South Africa: <https://sanac.org.za/reports/sa-nasa/>
  - Funding a tuberculosis-free future: an investment case for screening and preventive treatment: <https://www.who.int/publications/i/item/9789240091252>
  - An investment case for new tuberculosis vaccines: <https://www.who.int/publications/i/item/9789240091252>

## Appendices

### 1. Agenda (amended)

Time	Presentation Title	Speaker	Virtual / In-Person
8:00-8:30	Registration and Tea		
8:30-8:45	Brief intro and welcoming note from the TB Think Tank Secretariat, EMHE Task Team, and NDoH	Mrs. Erika Mohr-Holland, City of Cape Town/EMHE National TB Think Tank Dr. Priashni Subrayen, National TB Think Tank Secretariat Head/Aurum Institute	In-Person
<b>Part 1 (Introduction): Introduction to Mathematical Modelling and Health Economics</b>			
8:45-9:05	What is modelling and why does it matter? Simple introduction to tuberculosis mathematical modelling. Building modelling capacity in South Africa	Dr Cari van Schalkwyk, South African Centre for Epidemiological Modelling and Analysis, Stellenbosch University	Virtual
9:05-9:25	What is health economics and why does it matter? Simple introduction to modelling economic evaluations of TB programme intervention	Mr. Don Mudzengi, Aurum Institute	In-Person
9:25-10:00	Utility of TB modelling and health economics in National TB Strategic Planning (SA TB Investment Case)	Prof. Gesine Meyer-Rath; Health Economics and Epidemiology Research Office (HE <sup>2</sup> RO)	Virtual
<b>Tea Break 10:00-10:15</b>			
Time	Presentation Title	Speaker	Virtual / In-Person
<b>Part 2 (Symposium): Updates regarding current modelling work and research priorities</b>			
10:15-10:45	Keynote address / South Africa's efforts in fighting TB and priorities for Ending TB	Dr. Pren Naidoo, Consultant	In-Person
<b>Presentations by South African institutions/organisations leading TB Epidemiology work that informs mathematical models</b>			
10:45-11:00	National TB Epidemiology Updates, including the NTP-SP pillars, progress on implementation of the NTP-SP and TB Recovery Plans	Mr. Hlengani Mathema, TB Cluster, National Department of Health	In-Person
11:00-11:30	TB Prevention Updates, highlighting TPT implementation research studies	Prof. Violet Chihota, Aurum Institute	In-Person
11:30-12:00	Diagnostic Updates, highlighting the future diagnostic prospects	Dr. Kavindhran Velen, Foundation for Innovative New Diagnostics (FIND)	In-Person
12:00-12:30	TB in Children and TB Treatment Updates	Dr. Karen du Preez, Desmond Tutu TB Center, Stellenbosch University	In-Person
12:30-13:00	Targeted Universal Testing for TB (TUTT) and TUTT-plus, Finding TB among Men, and Sub-clinical TB	Prof. Neil Martinson, Perinatal HIV Research Unit (PHRU)	In-Person
<b>Updates and Showcase of Modelling and Health Economics Initiatives in South Africa</b>			
<b>Lunch Break 13:30-14:30</b>			
14:30-15:00	Updates on the National TB Model: Thembisa version 2.0 estimates, plans to include provincial level estimates and TB paediatric TB	Prof. Leigh Johnson, Centre for Infectious Disease Epidemiology and Research (CIDER), University of Cape Town	In-Person
15:00-15:30	Updates on the National TB Programme Costing; BPaL patient and provider costs	Prof. Denise Evans, Health Economics and Epidemiology Research Office (HE <sup>2</sup> RO)	In-Person
15:30-16:00	Modelling Research and Development Delivery Portfolios for TB in South Africa (unfortunately, did not take place)	Dr. Florian Marx, Heidelberg University, Germany	Virtual