



**SACEMA**  
DST/NRF Centre of Excellence in Epidemiological Modelling and Analysis

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## **SACEMA NEWSLETTER**

**No 13: July 2009**

### **NEWS:**

#### **Proposed *test-and-treat* strategy for the control of HIV**

A paper by Granich, et al published in The Lancet medical journal has shown that if people are tested for HIV once a year on average and start treatment as soon as they are found to be infected, it should be possible to eliminate HIV transmission by 2015 and infection by 2050. The vast majority of the theoretical work for this paper was carried out by Professor Brian Williams, Chairman of the SACEMA Board of Trustees. His involvement has particularly spurred SACEMA researchers to embark on a study to determine the feasibility of adopting a strategy of universal testing and immediate antiretroviral therapy for South Africa. It is believed that this strategy would reduce the rate of new infections by 48% in 2011 thus reaching the National Strategic Plan target. At a recent meeting of interested parties the issue was discussed at great length and it was decided to conduct a pilot study in both South Africa and Zambia. The project, to be coordinated by SACEMA, will be conducted in collaboration with the Desmond Tutu TB Centre (Stellenbosch University), Infectious Disease Epidemiology Unit (UCT), School of Public Health and Family Medicine (UCT), Centre for Infectious Diseases (Stellenbosch University) and the Department of Health (Western Cape).

Dr Tony Fauci, director of the US National Institute of Allergy and Infectious Diseases, gave his full support for this initiative.

#### **Accolades for paper co-authored by SACEMA visiting research fellow**

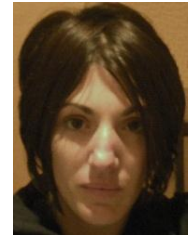
“Torr SJ, Della Torre A, Calzetta M, Costantini C and Vale GA. Towards a fuller understanding of mosquito behaviour: use of electrocuting grids to compare the odour-orientated behaviour of *Anopheles arabiensis* and *An. quadriannulatus* in the field. *Medical and Veterinary Entomology*, (2008) 22, 93-108” was judged by the Editorial Board of the Royal Entomological Society to be the best paper, with regard to the importance of its scientific content and the quality of its presentation, published in the journal in the two-year period 2007-2008. The paper was in the top-ten list of papers cited in the journal in 2008.

## NEW FACES AT SACEMA:



Natalie Roman is the new face of SACEMA, having joined in June as an administrative officer. She has several years work experience in financial administration.

Nelly Biondi is the new Health Economist at SACEMA. She joined SACEMA in May 2009. Her interests lie in performing economic evaluations of different healthcare interventions to inform decision makers on how best to allocate constrained health sector resources in the context of the double epidemics of HIV/AIDS and TB. Nelly completed a Masters degree in Statistical modelling with a major in Health Economics at ENSAI (French graduate engineering school in statistics and data analysis) in Rennes, France. She also has a Masters degree in Economics Science with a major in Econometrics from the University of Social Sciences in Toulouse.



## NEW MSC STUDENTS:



Josephine Ameh joined SACEMA in July after graduating from AIMS. She will be working on her MSc with Rachid Ouifki and John

Hargrove on modelling the dynamics of the transmission of trypanosomiasis.



Patrick Phepa also joined SACEMA in July after graduating from AIMS. He will be working on his MSc with Farai Nyabadza and

Rachid Ouifki on modelling the co-infection of HIV and other related diseases.

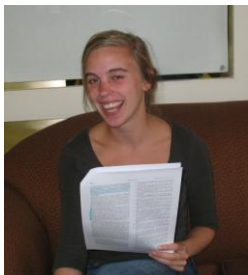
## ACADEMIC EXCHANGES:

Tendai Mugwagwa, a Ph.D. Student from the Bioinformatics Group from the University of Utrecht, is visiting SACEMA during the month of July to work with Dr Rachid Ouifki. Tendai's research area is Theoretical Immunology with a particular focus on developing mathematical models to interpret experimental data as well as quantifying turnover rates of different cell subsets. The aim of this visit is to finalize a paper on Dynamics of T-cell Receptor Circles TRECs and Telomere that Tendai and Rachid worked on together with Prof. Dr Rob J de Boer and Dr Jose Borghans (Tendai's supervisors) during Rachid's visit to their group at Utrecht University.



TRECs and telomere length have been used as markers for proliferative history and thymic output of T cells. Although it is agreed that infection with HIV is responsible for CD4 T cell loss, telomere length and TREC content data have been found to contradict each other on this. One would expect both to decrease as a result of chronic activation of CD4 T cells but TRECs seem to decrease while telomeres remain stable. Using a mathematical model for the dynamics of TRECs and Telomere we study the contribution of proliferation and thymic output and investigate the impact of HIV on them.

Jonathan Evans from the University of Southampton is visiting SACEMA for three months. The purpose of his visit is to research and write a dissertation for his MSc in Operational Research, based at the University of Southampton, England. He will be analysing the impact of age-disparate sexual relationships and their impact upon HIV transmission: in short, how does the variability in age of sexual partner(s) affect the transmission patterns of HIV, at the population level? The analysis will hopefully inform a wider discrete event simulation model that attempts to explicitly model the formation of sexual partnerships for individuals.



Veronique Suttels, a 2<sup>nd</sup> year master of medicine student from Ghent University in Belgium is also visiting SACEMA for three months. She is working under the supervision of Dr Wim Delva on her thesis titled "Qualitative analysis: determinants of partner choice in people living in Gugulethu". This study entails a qualitative analysis of face to face in-depth interviews with 28 couples from Gugulethu.

## **INTERNATIONAL MEETINGS:**

SACEMA MSc student, Bewketu Bekele attended a Summer Institute in Statistics and Modelling in Infectious Diseases (SISMID), at the University of Washington from 15 June to 24 July 2009. The program was organized by the department of Bio statistics at the University of Washington.

Lynnemore Scheepers attended the ICONZ inaugural meeting in Edinburgh, Scotland from 13 to 15 May 2009. The ICONZ project is funded by the European Union under the 7<sup>th</sup> Framework Programme. The ICONZ consortium comprises experts from 22 European and African Partner Institutes collaborating to develop effective strategies for integrated control of neglected zoonoses.

John Hargrove attended a follow-up meeting of the ICONZ project held in Uganda in July to discuss the role of the consortium partners in developing control and prevention strategies for neglected vector-borne zoonoses. A case study on human trypanosomiasis is being conducted in Uganda.

John Hargrove, Alex Welte, Brian Williams and Tom McWalter attended a meeting of the WHO special reference group on Incidence Estimation held for the first time in Cape Town from 16 to 17 July 2009.

John Hargrove, Brian Williams, Alex Welte and Tom McWalter also had the opportunity to meet with delegates of the 5<sup>th</sup> International Aids Society Conference on HIV Pathogenesis, Treatment and Prevention held in Cape Town from 19-22 July 2009.

## EVENTS:

### Inaugural Lecture



Visiting Research Fellow, Glyn Vale gave an inaugural lecture on 23<sup>rd</sup> June, as Professor of Insect Behaviour, at the University of Greenwich, Chatham Maritime Campus. The lecture was entitled "Science should be fun" and was attended by 145 people.

### SACEMA Seminar Series

The following seminars were held in the SACEMA boardroom during the second quarter of 2009:

- Bilkisu Abdulra'uf Bello: *"Multiple strain systems in the context of drug resistant HIV and a generalised SIR model"*.
- Veronique Suttels: *"Looking beyond the birds and the bees: Young people's sexual behaviour in Sub-Saharan Africa"*.
- Geomira Sanga: *"Modelling detection and delayed treatment on tuberculosis dynamics"*.

### US/Africa Data Modelling Clinic

DIMACS again teamed up with SACEMA to bring together postgraduate students from the USA and various African countries to pursue projects on the modelling of epidemiological issues. This year's course entitled "The Meaningful Modelling of Biological Data" was held at AIMS in Muizenberg from 11<sup>th</sup> to 16<sup>th</sup> May 2009. The aim was to engage participants in epidemiological modelling methodologies using real biological data and grappling with practical questions in a meaningful way. This year there were 25 participants from the USA, Africa and South Africa.



Data Modelling Clinic participants and faculty on the steps of the African Institute of Mathematical Sciences, Muizenberg

**Introductory course on the Applications of Mathematics in Biology and Medicine: 6 to 10 July 2009.**

SACEMA's annual introductory course on the use of mathematics in biology and medicine for 3<sup>rd</sup> year and Honours students was held at AIMS in Muizenberg from 6 to 10 July. The purpose of this course is to interest them in the use of mathematics to solve issues in biology or medicine. The course is run as a collaborative venture with AIMS, the Centre for Actuarial Research (CARE) at UCT and the Department of Mathematical Sciences at the University of Stellenbosch.

This year, a total of forty-nine students attended the course, from eleven universities around the country (Fort Hare, Limpopo, Nelson Mandela Metropolitan, North West, Pretoria, UCT, UKZN, UWC, Venda, Wits, and Zululand). They were addressed on a range of modelling subjects to demonstrate how mathematical modelling is used to address medical and biological problems. Copies of the lecture presentations will be available soon on the SACEMA website: <http://www.sacema.ac.za>



Participants and lecturers at the introductory course on the Applications of Mathematics in Biology and Medicine

## PUBLICATIONS:

### Journal Papers (published)

1. Chigidi, E. & Lungu, E.M. (2009) HIV model incorporating differential progression for treatment-naïve and treatment experienced infectives. *Mathematical Biosciences and Engineering*. 6(3): 427-450.
2. Lindh, J.M., Torr, S.J., Vale, G.A. & Lehane, M.J. (2009) Improving the Cost-Effectiveness of Artificial Visual Baits for Controlling the Tsetse Fly *Glossina fuscipes fuscipes*. *PLOS Neglected Tropical Diseases* May 2009, 3(5): e435
3. Mahiane, S.G., Legeai, C., Taljaard, D., et al. (2009) Transmission probabilities of HIV and herpes simplex virus type 2, effect of male circumcision and interaction: a longitudinal study in a township of South Africa. *AIDS* 23(3): 377-383.
4. Nyabadza, F., Mukwembi, S. & Rodrigues, B. (2009) Modelling TB interactions: a case of 'reasonable' and 'unreasonable' infectives. *Physica*. DOI:10.1016/j.physica.200901.039.
5. Omolo, M.O., Hassanali, A., Mpiana, S., Esterhuizen, J., Lindh, J., Lehane, M.J., Solano, P., Rayaisse, J.B., Vale, G.A., Torr, S.J. & Tirados, I. (2009) Prospects for Developing Odour Baits To Control *Glossina fuscipes* spp., the Major Vector of Human African Trypanosomiasis. *PLOS Neglected Tropical Diseases* July 2009, 3(7): e474
6. Uys, P.W., Warren, R., van Helden, P.D., Murray, M. and Victor, T.C. (2009) Potential of rapid diagnosis for controlling drug-susceptible and drug-resistant tuberculosis in communities where Mycobacterium tuberculosis infections are highly prevalent. *Journal of Clinical Microbiology* 47 (5) 1484- 1490.
7. Welte, A., McWalter, T.A. & Bärnighausen, T. (2009) A Simplified Formula for Inferring HIV Incidence from Cross-Sectional Surveys Using a Test for Recent Infection. *AIDS Research and Human Retroviruses* January 2009, 25(1): 125-126.
8. Welte, A., McWalter, T.A. & Bärnighausen, T. (2009) A Simplified Formula for Inferring HIV Incidence from Cross-Sectional Surveys Using a Test for Recent Infection. *Aids Research and Human Retroviruses* 25(1): 125-126
9. Williams, B.G., Ginsburg, D., Montaner, J., Stander, T. & Welte, A. (2009) Achieving South Africa's National Strategic Plan for HIV/AIDS. *The Lancet* March 2009, 373: 895-896

### Conference/Poster Presentations

1. Bärnighausen, T., Wallrauch, C., Welte, A., McWalter, T., Mbizana, N., Viljoen, J., Graham, N., Tanser, F., Puren, A. & Newell, M-L. Comparison of HIV incidence and risk factors for recent infection based on longitudinal follow-up versus cross-sectional cBED assay testing: a study in rural South Africa. *Poster displayed at the 16<sup>th</sup> Conference on Retroviruses and Opportunistic Infections (CROI), February 2009, Montreal Canada.*
2. Delva, W., Vansteelandt, S., Pretorius, C., Williams, B., Hargrove, J., Annemans, L., Temmerman, M. Modelling the impact of combination HIV prevention. *Presentation at the 4<sup>th</sup> South African AIDS Conference, 31 March-3 April 2009, Durban, South Africa.*
3. Hargrove, J. A case study of the application of the BED method for the estimation of HIV incidence. *Presentation at the 4<sup>th</sup> South African AIDS Conference, 31 March-3 April 2009, Durban, South Africa.*
4. Hargrove, J., Williams, B.G. The HIV Epidemic in South Africa – Provenance and Prospects. *Keynote address at the 4<sup>th</sup> South African AIDS Conference, 31 March-3 April 2009, Durban, South Africa.*

5. Mahiane, S.G., Ouifki, R., Auvert, B. Statistical and mathematical analysis of the dynamics of HIV and HSV-2 co-infection. *Presentation at the 4<sup>th</sup> South African AIDS Conference, 31 March-3 April 2009, Durban, South Africa.*
6. Nyabadza, F. On the role of mathematical models in HIV/AIDS interventions. *Presentation at the 4<sup>th</sup> South African AIDS Conference, 31 March-3 April 2009, Durban, South Africa.*
7. Pretorius, C., Williams, B., Delva, W., Verguet, S. Intergenerational sex and the epidemic of HIV *Presentation at the 4<sup>th</sup> South African AIDS Conference, 31 March-3 April 2009, Durban, South Africa.*
8. Rosner, Z., Welte, A., McWalter, T., Newell, M-L. & Bärnighausen, T. Use of the cBED enzyme immunoassay for HIV incidence estimates: a systematic review. *Presentation at the 4<sup>th</sup> South African AIDS Conference, 31 March-3 April 2009, Durban, South Africa.*
9. McWalter, T.A., Welte, A. & Laeyendecker, O., Evaluating Performance of Cross-Sectional Incidence Estimators: A Challenge for Assay Development. *Presentation at the 4<sup>th</sup> South African AIDS Conference, 31 March-3 April 2009, Durban, South Africa.*
10. Hargrove, J., Humphrey, J., Mostert, P., du Toit, Cari, Welte, A. & McWalter, T. Estimating the window period for the BED method. *Poster displayed at the 4<sup>th</sup> South African AIDS Conference, 31 March-3 April 2009, Durban, South Africa.*

#### **Journal Papers (accepted for publication)**

1. Ferrand, R.A., Corbett, E.L., Wood, R., Hargrove, J., Ndhlovu, C.E., Cowan, F.M., Gouws, E. & Williams, B.G. AIDS among adolescents in Southern Africa: projecting the time course and magnitude of the epidemic. *AIDS*
2. Hargrove, J.W. BED estimates of HIV incidence must be adjusted. *AIDS*
3. Marinda, E.T., Hargrove, J., Preiser, W., Slabbert, H., van Zyl, G., Levin, J., Moulton, L.H., Welte, A. & Humphrey, J. Significantly diminished long-term specificity of the BED Capture Enzyme Immunoassay among HIV-1 patients with very low CD4 counts and those on anti-retroviral therapy. *Journal of Acquired Immune Deficiency Syndromes (JAIDS)*
4. McWalter, T.A. & Welte, A. Relating Recent Infection Prevalence to Incidence with a Sub-population of Assay Non-progressors. *Journal of Mathematical Biology.*
5. UNAIDS/WHO/SACEMA Expert Group on Modelling the Impact and Cost of Male Circumcision for HIV Prevention. Male circumcision for HIV prevention in high HIV prevalence settings: what can mathematical modelling contribute to informed decision making? *PLoS Medicine*
6. Welte, A., McWalter, T.A. & Bärnighausen, T. Response to Brookmeyer: ‘Should biomarker estimates of HIV incidence be adjusted?’ *AIDS*
7. Williams, B.G., Welte, A., Auvert, B. & Hargrove, J. Letter in response to paper by Crum-Cianflone *et al.* “Is HIV Becoming More Virulent? Initial CD4 Cell Counts among HIV Seroconverters during the Course of the HIV Epidemic: 1985 to 2007” *Clinical Infectious Diseases (CID).*