Elisha B. Are

Postdoctoral Researcher & Term Lecturer

Mathematics Department
Simon Fraser University
8888 University Dr W, Burnaby, BC V5A 1S6

elisha_are@sfu.ca +1 604 679 87 47

Skills

Epidemiological modeling and analysis; Rapid response modelling of emerging diseases of public health concern; Data analysis; Applied Mathematics, Complex systems, Optimal control, Structural dynamics, and fluid mechanics.

Experience

Mathematics Department, Simon Fraser University / Postdoctoral Researcher
September 2020 - Present, Burnaby, Canada

Research, communication of findings, collaboration with policy makers (Public Health Agency of canada (PHAC) etc.) and public health experts, on COVID-19 modelling

Mathematics Department, Simon Fraser University /Term Lecturer
January 2023 - Present, Burnaby, Canada

Prepare course material and deliver lectures, prepare, administer, and grade examinations

Global Canada Initiative

Modeller (contract)
November 2020 - February, 2021 , Online
Scenario modelling and forecasting of COVID-19 cases in Canada

DST/NRF Centre for Excellence in Epidemiological Modelling and Analysis (SACEMA), Stellenbosch University/ Research Associate
September 2020 - Present, Stellenbosch, South Africa

Research collaborations with SACEMA staff and students

DST/NRF Centre for Excellence in Epidemiological Modelling and Analysis (SACEMA), Stellenbosch University/ PhD fellow
March 2018 - August 2020, Stellenbosch, South Africa

Research, Undergraduate student mentoring

Federal University Oye-Ekiti / Assistant Lecturer/Graduate Assistant
MONTH 2015 - April 2021, Oye-Ekiti, Nigeria

Research; Undergraduate teaching; Student mentoring and supervision Community services and outreach

Education

SACEMA, Stellenbosch University / PhD. Mathematics
March 2018- August 2020, Stellenbosch, South Africa

Thesis: Extinction Probabilities for Tsetse Population (*Glossina Spp*) in a world of Changing Climate

University of Ilorin / Msc. Mathematics (with distinction)
June 2014 - December 2015, Ilorin, Nigeria
Thesis: A generalized mathematical model of outbreak of ebola virus disease with dead infectives

University of Ilorin / Bsc. Mathematics (with First Class)
October 2009 - July 2013, Ilorin, Nigeria
Thesis: Dynamic effects of viscous damping on isotropic rectangular Plates resting on Pasternak foundation, subjected to moving loads

Further Education/Courses attended

- Software Engineering for Applied Mathematical Sciences (SEAMS) Stellenbosch University (2020)
- Training in Environmental Health and Epidemiology. Stellenbosch University (2018)
- Advance course in Epidemiological methods. Stellenbosch University (2018)
- Data management in R. Stellenbosch University (2018)

Teaching experience

Teaching Experience (Simon Fraser University)- Instructor
Calculus for Life Sciences I (MATH 154, spring 2023)

Calculus for Life Sciences II (MATH 155, spring 2024)

Clinic on Dynamical Approaches to Infectious Disease Data (DAIDD)-Faculty Member (2023): A virtual modelling school which is part of the International Clinics on Infectious Disease Dynamics and Data Program (ICI3D).

Teaching Experience (Federal University Oye-Ekiti (2015–2019)- Instructor
MTH 101: Elementary Set Theory & Numbers. 3 Units (2015/2016 & 2017/2018)

MTH 102: Advanced Calculus (2015/2016 & 2016/2017)

MTH 103: Vectors, geometry, and dynamics. 3 Units (2015/2016 & 2017/2018)

MTH 104: Elementary Algebra and Trigonometry. 3 Units (2015/2016)

MTH 201: Mathematical Methods. 3 Units (2017/2018)

MTH 202: Elementary differential Equation. 3 Units (2016/2017)

MTH 307: Real analysis. 3 Units (2016/2017)

MTH 302: Ordinary differential Equation. 3 Units (2016/2017)

MTH 317: Geometry. 3 Units (2016/2017 & 2017/2018)

Student supervision Experience

Temitope Gloria Sikiru (Federal University Oye-Ekiti)

An epidemiological approach to the study of the growth dynamics of political parties in a multiparty system (completed).
BSc. Honours in Mathematics (2017)

Honey Madlala (University of KwaZulu-Natal)
Modelling the impact of changing temperature on tsetse population
MSc. in Mathematics (2020)

Awards

- Winner of SACEMA/The Conversation Africa writing competition **2019** (R5000 cash price)
- Federal University Oye-Ekiti Professor Cecilia Akintayo 3rd most published faculty member for 2020.
- Best poster pitch during SACEMA Research Days **2019** (R750 Takealot voucher)
- Top 100 Mathematicians selected globally to attend the 6th Heidelberg Laureate Forum **2018**. Doctoral Category
- Stellenbosch University bursary to attend the course: *Preparing for the PhD* (7 – 11 January **2019**) at the African Doctoral Academy's Summer School 2019, Stellenbosch University, Stellenbosch, South Africa.
- DST/NRF Centre for Excellence in Epidemiological Modelling and Analysis (SACEMA) PhD Fellowship **2018**: Full PhD scholarship.
- Jury's choice award: Poster presentation at the Hands-on school on complex systems. Held at Abdus Salam International centre for theoretical physics (ICTP), Trieste, Italy, 17th -29th July **2016**

Synergistic Activities

Participant: The CIHR Institute of Infection and Immunity's Focus Group: Capacity Building Initiative for a More Diverse Research Community. Fall 2021

Peer Reviewer: EPIDEMICS 9 - 9th International Conference on Infectious Disease Dynamics. Epidemics-PLoS one (multiple)-Journal of Theoretical Biology (multiple) -BMC Infectious Diseases (multiple) -Frontiers in Veterinary Science, section Veterinary Epidemiology and Economics- Bulletin of Mathematical Biology (Multiple) - Journal of Mathematical Biology-AMS Mathematical Biosciences and Engineering

Press appearances: I appeared on many TV and radio stations in 2021 & 2022 discussing possible impact of spread of high-transmission COVID-19 variants in Canada

Mentor: International Clinics on Infectious Disease Dynamics and Data (ICI3D) Program. Clinic on Dynamical Approaches to Infectious Disease Data (DAIDD). Organised by the South African Centre for Epidemiological Modelling and Analysis. Held virtually (**2022**)

Member of BC COVID-19 modelling group: An independent interdisciplinary modelling group including experts in epidemiology, Mathematics, and data analysis from UBC, SFU, UVic, and supported by Pacific institute for the Mathematical sciences working on rapid response COVID-19 pandemic modelling, providing regular COVID-19 modeliing projections to inform the general public and policy makers.

Member of SACEMA Modelling and Analysis Response Team: Providing modelling support as needed for rapid response to emerging infectious diseases

Mentor: International Clinics on Infectious Disease Dynamics and Data (ICI3D) Program. Clinic on meaningful modelling of epidemiological data. Organised by the South African Centre for Epidemiological Modelling and Analysis. Held at the African Institute for Mathematical Sciences (AIMS), Muizenberg, South Africa (**2019**)

Facilitator: Science in context: A program initiated by the the Faculty of science, Stellenbosch University, in **2018**. Designed to give first year undergraduate students exposure to contemporary issues in science that require interdisciplinary perspectives.

Team coach: 9th National Mathematics Competition for University Students (NAMCUS), Nigeria. In **2017**, I coached a team of four undergraduate students who represented the Mathematics Department Federal University Oye-Ekiti, in the competition. The team won three bronze medals.

Co-organizer: Commemoration of the World Health Organization' world malaria day 2017, on 25th April 2017 at the Federal University Oye Ekiti.

Co-organizer: First undergraduate mini-conference on 24 June **2015**, at the Federal University Oy-Ekiti.

Research grants

- Stellenbosch University Subcommittee B funding for young researchers. **June 2020 – August 2022. Total value $ 8764**

  Project: Spatio-temporal trends of HIV prevalence in the Southern Africa sub-region. **Role**: Co-investigator

- TETFUND Institution Based Research Fund (IBRF) Ref No.: TETF/DAST and D.D./6.13/NOMCA/BAS (P.V. No. 090403): **January 2016– January 2017 Total value $5000**

  Project: Lassa Fever disease dynamic modeling in Nigeria. **Role**: Co-investigator

- West African Research Association (WARC) fellowship: **Total value $3000**

  Project: Modelling the impact of counterfeit drugs on the control of malaria-typhoid co-infection in Nigeria. Conducted at Institut De Mathemaiques Et De Sciences Physiques (IMPS) Republic of Benin. **January 2018. Role**: Principal investigator

Travel grants

- Forum on Science, Policy, and Society– Science outside the Laboratory in Vancouver and Victoria: **6-13 May 2023.** Travel grant and a full scholarship to attend.
- Fields Institute for Research in Mathematical Sciences travel grant up to **$2000** to attend Mathematics for Public Health Festival (MfPHest) **26th October - 28th October 2022,** at the Field Institute, University of Toronto, Canada.

- AIMS -NEI: Travel grant with fully sponsored lodging and board to attend AIMS-NEI Future of Science conference. **7 – 9 July 2019**, AIMS Rwanda, Kigali, Rwanda.
- SACEMA post graduate travel grants to a meeting on "Epidemiological consequence of reproductive senescence in long-lived vectors", from **27 - 28 of March 2019** at the Liverpool School of Tropical Medicine (LSTM), Pembroke Place Liverpool, United Kingdom.
- Heidelberg Laureate Forum foundation: Travel grant and full lodging and board to attend 6th Heidelberg laureate forum, Heidelberg, Germany **22nd September – 29th 2018**.
- International Clinics on Infectious Disease Dynamics and Data (ICI3D) Program: travel grant with fully sponsored lodging and board to attend; Clinic on meaningful modelling of epidemiological data (2017). Organised by the South African Centre for Epidemiological Modelling and Analysis. Held at the African Institute for Mathematical Sciences (AIMS), Muizenberg, South Africa (**2017**)
- The Heidelberg Graduate School of Mathematical and Computational Methods for the Sciences (HGS MathComp): Travel grant with fully sponsored lodging and board to attend IWR-AIMS summer school on Mathematical modelling and scientific computing. Held at African institute for mathematical sciences (AIMS), Cape Town, South Africa (**2017**)
- IMSP/CEA-SMA/World Bank travel grant with fully sponsored lodging and board to attend: Ecole D'Analyse 2016 Au Benin. Le Chant d'osiseau, Cotonou, Republic of Benin (**2016**).
- ICTP travel grant, with fully sponsored lodging and board to attend Hands-on-school on complex systems in Trieste, Italy (**2016**).
- Welcome Trust/MORU travel grant up to $2,000 with fully sponsored lodging and board to attend Mathematical modelling school in Bangkok, Thailand (**2016**)
- AMMSI/AAS travel grant up to #40,000 with fully sponsored lodging and board to attend AAS/AMU pre-symposium school in Abuja, Nigeria (**2016**).
- CIMPA travel grant up to €800, with fully sponsored lodging and board to attend CIMPA School in Naivasha, Kenya (**2015**)

Invited talks

- Field Institute MfPH Next Generation Seminar Series (January 5, 2022) Ontario Canada - Virtual seminar

  Talk: COVID-19 endgame: from pandemic to endemic? Vaccination, reopening and evolution in highly vaccinated settings

- Modelling in the Context of African Health Durban, South Africa (December 9-19, 2021)

  Plannary talk: Scenario modelling of possible impact of Omicron in a low-vaccinated population

Selected presentations

Poster presentation: The Hidden Costs of Covid: The Rising Burden of Chronic Disease in a Post-Pandemic World 27-31 August 2023. Keyston Symposium: Long COVID and Post Acute Sequalae of SARS CoV 2 (PASC): Pathogenesis and Treatment, Santa Fe, NM, USA.

Oral Presentation: “Insect demography: does it matter if we count babies or mummies? ” presented at the Modelling in the context of African health conference, 14-16 October 2019, UKZN, Durban, South Africa.

Oral Presentation: “Extinction probabilities for tsetse (*Glossina* spp) populations in a world of changing climate” presented at the meeting on "Epidemiological consequence of reproductive senescence in long-lived vectors", from 27 - 28 of March 2019 at the Liverpool School of Tropical Medicine (LSTM), Liverpool, United Kingdom.

Oral Presentation: “The weakest link: Exploring global uncertainty and sensitivity of extinction probability for tsetse (*Glossina* spp)” Presented at SACEMA seminar series, 17 October 2018, SACEMA, Stellenbosch University, South Africa

Poster Presentation: Modelling the effect of mass dog vaccination delivery strategies on time to rabies elimination in rural Kenya. Epidemics7, Charleston, United States (presented by a co-author) December 2019.

Poster Presentation: “Mathematical model of Ebola virus disease with dead infectives offers insight into disease control”
Hands-on research school in complex systems: Held at Abdus Salam International centre for theoretical physics (ICTP), Trieste, Italy, 17th -
29th July 2016.

Poster Presentation: “Structural identifiability of high dimensional SIR type epidemiological model”
Clinic on meaningful modelling of epidemiological data (2017). Organised by the South African Centre for Epidemiological Modell ing and
Analysis. Held at the African Institute for Mathematical Sciences (AIMS), Muizenberg, South Africa (2017)

Peer-reviewed publications

1. James M. Azam, Xiaoxi Pang, **Elisha B. Are**, Juliet R.C. Pulliam, Matthew J. Ferrari (2023) Modelling outbreak response impact in human vaccine-preventable diseases: A systematic review of differences in practices between collaboration types before COVID-19. *Epidemics. 45 (12), 100720* https://doi.org/10.1016/j.epidem.2023.100720
2. **Are EB**, Song Y, Stockdale, JE, Tupper P, Colijn C (2023) COVID-19 endgame: from pandemic to endemic? Vaccination, reopening and evolution in low and high vaccinated populations. *Journal of Theoretical Biology*, 559, 111368 **https://www.sciencedirect.com/science/article/pii/S0022519322003599**
3. **Are, EB**., Hargrove, J.W. & Dushoff, J. Does Counting Different Life Stages Impact Estimates for Extinction Probabilities for Tsetse (*Glossina* spp)? (2021). *Bull Math Biol* 83, 94 . https://doi.org/10.1007/s11538-021-00924-1
4. Adetokunboh OO, **Are EB**.(2020) Distribution and determinants of HIV prevalence in South Africa. Annals of epidemiology. 2020 Dec 1;52:116.

5. Pearson Carl AB, Van Schalkwyk Cari, Foss Anna M, O'Reilly Kathleen M, SACEMA Modelling and Analysis Response Team*, CMMID COVID-19 working group, Pulliam Juliet RC. Projected early spread of COVID-19 in Africa through 1 June 2020. Euro Surveill. 2020;25(18):pii=2000543. https://doi.org/10.1371/journal. Pntd.0006973

6. **Are EB**, Hargrove JW (2020) Uncertainty and sensitivity analyses of extinction probabilities suggest that adult female mortality is the weakest link for populations of tsetse (*Glossina* spp). PLoS Negl Trop Dis 14(5): e0007854. https://doi.org/10.1371/journal.pntd.0007854

7. **Are EB**, Hargrove JW (2020) Extinction probabilities as a function of temperature for populations of tsetse (*Glossina* spp.). PLoS Negl Trop Dis 14(5): e0007769. https://doi.org/10.1371/journal.pntd.0007769
8. Kajunguri D, **Are EB**, Hargrove JW (2019) Improved estimates for extinction probabilities and times to extinction for populations of tsetse (Glossina spp) . PLoS Negl Trop Dis 13(4): e0006973.
9. Azam, JM **Are EB**, Pang, X, Ferrari, MJ, Pulliam, JRC. (2020). Protocol for a systematic review of outbreak response intervention models of vaccine-preventable diseases in humans, and foot-and-mouth disease in livestock. https://bmjopen.bmj.com/content/10/10/e036172 BMJ Open
10. Bakare, E.A, . **Are, E.B**, Osanyinlusi, S.A et al. ,(2020) Mathematical Modelling and Analysis of Transmission Dynamics of Lassa fever. Journal of Applied Mathematics. Vol 2020, Article ID 6131708 https://doi.org/10.1155/2020/6131708
11. James Azam, **Are, E.B**, Xiaoxi Pang, Matthew Ferrari, Juliet Pulliam (2020). A systematic review of outbreak response intervention models of vaccine-preventable diseases in humans, and foot-and-mouth disease in livestock. PROSPERO 2020 CRD42020160803. https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42020160803
12. Osanyinlusi, S.A. **Are, E.B**, and Bakare, E.A (2018): Modelling the role of wild rodents in the Dynamics of transmission of Hepatitis E Virus with zoonotic potential. Confluence Journal of Pure and Applied Sciences. 2 (1) 41-49.
13. Idowu, A.S, **Are, E.B**, Gbadeyan, J.A (2017): Vibration analysis of damped orthotropic rectangular plates with Simple support on elastic Winkler foundation, subjected to moving loads. International Journal of applied mechanics and Engineering 22(4) 1075- 108.
14. Idowu A.S, Dada M.S, Babalola O.T, Yusuf T.A , **Are E.B** (2016): DTM-Pade Solution for Heat transfer of Hydromagnetic Flow over a vertical plate. Journal of the Nigerian Association of mathematical physics 36(1) 153-162

15. Bakare, E.A and **Are, E.B** (2016): Impact of multiple control strategies on mathematical modelling of cholera transmission dynamics with asymptotic transmission. Journal of the Nigerian Association of mathematical physics 36(1) 107-116.

Preprints

- Are EB, Kiffer C, Colijn C The Role of Vaccine Status Homophily in the COVID-19 Pandemic: A Cross-Sectional Survey with Modeling (2023). MedRxiv https://doi.org/10.1101/2023.06.06.23291056

- Are EB, Colijn C (2021) Projected spread of COVID-19's second wave in South Africa under different levels of lockdown . MedRxiv https://doi.org/10.1101/2021.01.22.21250308

Submitted/in preparation

- **Are EB**, Dushoff J , Hargrove JW (2023) Estimating the intrinsic growth rates for tsetse (*Glossina* spp) populations in the world of changing climate. (*In preparation*)

- **Are EB,** Stockdale, J. E., & Colijn, C. (2023) Long term dynamics of COVID-19 in a multi-strain model. Peer-reviewed: *Springer book chapter* (ACCEPTED)

Non-peer reviewed publications

Are EB, Colijn C. (2021). High transmission variants: The benefits of being proactive https://www.sfu.ca/magpie/blog/variant-simple-proactive.html

Are EB, Colijn C. (2021), High-transmission variants in Canada https://www.sfu.ca/magpie/blog/high-transmission-variant-modelling.html

Are EB, Hargrove JW: What changes in temperature mean for Africa's tsetse fly. The Conversation Africa. Published on 16 January 2020 (With more than 10000 reads, so far) **https://theconversation.com/what-changes-in-temperature-mean-for-africas-tsetse-fly-125663**

TECHNICAL REPORT

Are EB (2018) Modelling the impact of counterfeit drugs on the control of malaria-typhoid co-infection in Nigeria. Submitted to West African Research Association (WARA), African Studies Center, Boston University, USA

Membership of professional bodies

American Mathematical Society (AMS) member (2023-present)

Canadian Mathematical Society (CMS) member (2023-present)

West African Research Association (WARA) member (2017-2018)

Nigerian Mathematical Society (NMS) member (2013-present)

Technical skills

Proficient in R, Git, MATLAB, NetLogo, MAPLE, LaTeX, R Markdown,

MS Word, MS PowerPoint, LaTeX Beamer, and MS Excel.

Membership of committees

- Mathematics department, Simon Fraser University, Equity Diversity and Inclusion (EDI) committee (2021- 2022)
  Role: **Member**
- SACEMA communication committee (July 2019 – December 2020)
  Role: **Member**
- Faculty of Science Federal University Oye-Ekiti
  Computer Based Test (CBT) Committee (2017) Role: **Secretary**