

Michael Li

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Research interests

I am a theoretical/computational infectious disease modeler. I focus on human-related diseases (HIV, influenza, and currently COVID-19) and some wildlife diseases (canine rabies), especially in forecasting epidemic outbreaks, retrospective analysis of the evolution of infectious diseases and intervention strategies/policies for disease control. I have a broad research interest in theoretical and applied statistics, mathematical biology, ecology & evolution, public health and computations.

Employment history

Senior Scientist: Public Health Risk Science Division (PHRS), Public Health Agency of Canada (PHAC)
2020–present

- Developing models, forecasts and analysis as part of the PHAC modelling team to inform the Government of Canada’s COVID response including requests directly from the Office of the Chief Public Health Officer (OCPHO) and outputs provided to the Prime Minister’s Office (PMO)
- Developing tools and pipelines for COVID and waste water surveillance and analysis

Research Associate: South African Centre for Epidemiological Modelling and Analysis (SACEMA),
2020–present

- Developing models to fit and forecast COVID risk and public health demands for South Africa (provincial and national level), and Afro-Regional (49 countries).

Postdoctoral fellow: McMaster University, 2019–2020. Supervisor: Dr. Jonathan Dushoff

- Developing models to fit and forecast COVID risk and public health demands for Canadian provinces, and another large (confidential) jurisdiction.
- Dynamical analysis of spatiotemporal data streams to support elimination of canine rabies.

Education

Ph.D., Biology, McMaster University, 2015–2019. Thesis: *Methods For Modeling The Spread of Infectious Disease*. Supervisors: Dr. Ben Bolker, Dr. Jonathan Dushoff

- Developing models and tools for emerging disease outbreaks
- Reassessing global historical risk of canine rabies
- Exploring heterogeneities and bias of generation time in disease transmission mechanism (canine rabies)
- Developing computational efficient tools for phylogenetic mixed effect modeling

M.Sc., Statistics, McMaster University, 2013–2015. Thesis: *Incorporating Temporal Heterogeneity in Hidden Markov Models For Animal Movement*. Supervisor: Dr. Ben Bolker

HB.Sc., Statistics and Mathematics, University of Toronto: 2009–2013

Grant funding

CANMOD: Canadian Network for Modelling Infectious Disease. NSERC. Apr 2021. \$2,500,000. Collaborator. PIs: Caroline Colijn, David J.D. Earn.

Combining data streams to support elimination of canine rabies: dynamical analysis of spatiotemporal data. CIHR. Oct 2019 - Sept 2022. \$232,780. Co-investigator. PIs: Jonathan Dushoff, Katie Hampson

Professional service

Modeller Part of [MacTheobio COVID modelling team](#) that provides COVID-19 infection report forecasts for the province of Ontario to the Ontario Modelling Consensus Table (MCT), a partner of the Ontario Science Advisory Table (SAT), which presents this information to the Health Coordination Table of the Ontario Ministry of Health.

MS. reviewer For *New England Journal of Medicine*; *Epidemics*; *Journal of Agricultural, Biological, and Environmental Statistics*; *Journal of Animal Ecology*; and *Movement Ecology*.

Researcher

Statistics Canada Research Data Centre (RDC) at McMaster University (2014-2018)

Publications

Publicly available government reports and presentations

[The COVID-19 Public Health Agency of Canada \(PHAC\) Modelling Report](#)

[PHAC National modelling presentation](#) for Feb-19, Mar-26, Apr-23 and May-28-2021.

[Provincial](#) and [National](#) Projection reports for Republic of South Africa.

Research Articles

- Otto, S.P., Day, T., Arino, J., Colijn, C., Dushoff, J., **Li, M.**, Mechai, S., Van Domselaar, G., Wu, J., Earn, D.J.D., Ogden, N., 2021. The evolving COVID-19 pandemic: the origins and potential future of SARS-CoV-2 variants of concern, *Current Biology* (Accepted)
- Papst, I., **Li, M.**, Champredon, D., Bolker, B.M., Dushoff, J. and Earn, D.J., 2021. Age-dependence of healthcare interventions for COVID-19 in Ontario, Canada. *BMC Public Health*, 21(1), pp.1-9.
- Park, S.W., Sun, K., Champredon, D., **Li, M.**, Bolker, B.M., Earn, D.J., Weitz, J.S., Grenfell, B.T. and Dushoff, J., 2021. Forward-looking serial intervals correctly link epidemic growth to reproduction numbers. *Proceedings of the National Academy of Sciences*, 118(2).
- Park SW, Bolker BM, Champredon D, Earn DJD, **Li M**, Weitz JS, Grenfell BT, Dushoff J. “Reconciling early-outbreak estimates of the basic reproductive number and its uncertainty: framework and applications to the novel coronavirus (SARS-CoV-2) outbreak.” *Journal of The Royal Society Interface*. July 2020; 17:168
- **Li M**, Bolker BM, Dushoff J, Ma J, Earn DJD. Patterns of seasonal and pandemic influenza-associated health care and mortality in Ontario, Canada. *BMC Public Health*. 2019 Dec 1;19(1):1237.
- Shi, C. F., **Li, M.**, & Dushoff, J. “Traditional Male Circumcision is Associated with Sexual Risk Behaviors in Sub-Saharan Countries Prioritized for Male Circumcision.” *AIDS and behavior* (2019): 1–9.

- **Li, M.**, Dushoff, J., & Bolker, B. M. (2018). Fitting mechanistic epidemic models to data: a comparison of simple Markov chain Monte Carlo approaches. *Statistical methods in medical research*, 27(7), 1956–1967.
- Shi, C. F., **Li, M.**, & Dushoff, J. (2017). Evidence that promotion of male circumcision did not lead to sexual risk compensation in prioritized Sub-Saharan countries. *PloS one*, 12(4), e0175928.
- Champredon, D., **Li, M.**, Bolker, B.M. and Dushoff, J., 2018. Two approaches to forecast Ebola synthetic epidemics. *Epidemics*, 22, pp.36-42.
- **Li, M.**, & Bolker, B. M. (2017). Incorporating periodic variability in hidden Markov models for animal movement. *Movement ecology*, 5(1), 1.

Preprint Articles

- Ben Bolker, **Michael Li**, Jonathan Dushoff, David Earn, Zachary Levine, Ali Gharouni, Matthew So, Irena Papst, Steve Walker. (2021, May 27). `bbolker/McMasterPandemic`: Initial release for Zenodo (Version v.0.0.19.002). Zenodo. <http://doi.org/10.5281/zenodo.4820013>
- **Michael Li**, & Ben Bolker. (2019, April 15). `wzmli/phyloglmm`: First release of phylogenetic comparative analysis in lme4-verse (Version v1.0.0). Zenodo. <http://doi.org/10.5281/zenodo.2639887>

Oral Presentations

Invited talks

- Challenges in Modeling SARS-CoV-2: Bridging the Best of Both Worlds Between Models and Reality; DST-NRF Centre of Excellence in Epidemiological Modelling and Analysis (SACEMA) seminar 26 Jun 2020
- Exploring disease patterns using generation time; McMaster University Ecology, Evolution & Behaviour (EEB) seminar; 29 Jan 2020
- Estimating epidemic speed and strength: The role of disease-generation intervals. University of Glasgow Institute of Biodiversity, Animal Health & Comparative Medicine Institute seminar series; 30 Oct 2019;

Contributed talks and posters

- **Poster**: Estimating generation intervals in heterogeneous populations; Ecology and Evolution of Infectious Disease (EEID); Jun 2019; Princeton, NJ, USA
- **Poster**: Patterns of influenza-associated health care and mortality in Ontario; Canadian Research Data Centre Network (CRDCN) Conference; Oct 2018, Hamilton, ON, Canada
- **Contributed talk**: Reformulating phylogenetic mixed models to improve flexibility and speed; International Statistical Ecology Conference (ISEC); July 2018; St. Andrews, UK
- **Poster**: Reassessing global historical R0 estimates of canine rabies; Ecology and Evolution of Infectious Disease (EEID); Jun 2018; Glasgow, UK
- **Poster**: Latent state models for Epidemiological and Outbreak Analysis; Ecology and Evolution of Infectious Disease (EEID); Jun 2016; Ithaca, NY, USA
- **Poster; award best poster prize**. Modelling High-Resolution Animal Telemetry Data: Hidden Markov Models and Extensions; Statistical Society of Canada (SSC); Jun 2015; Halifax, NS, Canada

Teaching experience

Teaching Assistant (McMaster University)

- Bio 3SS3 “Population Ecology” (winter 2016, 2017, 2018, 2019)
- Bio 3FF3 “Evolution” (fall 2018)
- Bio 1M03 “Ecology and Evolution” (fall 2015, 2016, 2017)
- Stat 3J3Y “Probability and Statistics for Engineering” (fall 2013, 2014, winter 2014)
- Stat 2MB3 “Statistical Methods and Applications” (winter 2014)
- Math 1F03 “Introduction to Calculus and Analytic Geometry” (fall 2014)