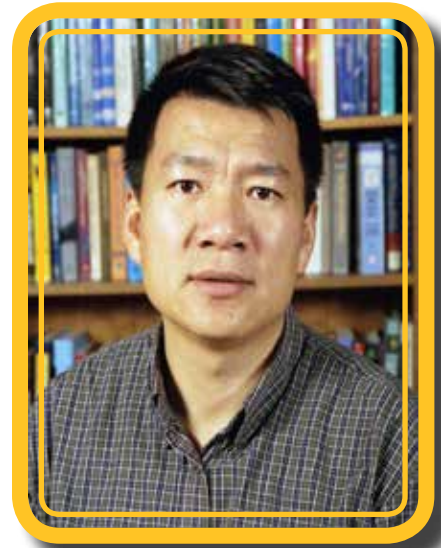


# DEPARTMENT OF MATHEMATICS & STATISTICS



UNIVERSITY  
OF WYOMING



Thursday

February 24, 2022- 4:10-5pm

Zoom: <https://uwyo.zoom.us/j/2815118676>

**Michael Li**

University of Alberta

## Why do Mathematical Models Over-Project COVID-19 Epidemics?

### Abstract:

During the COVID-19 pandemic, mathematical modeling has been widely adopted as a research tool for public health, and modelling results have played an important role informing public health responses to COVID-19. Through two years of highly intensified modeling activities, it has also become apparent that mathematical models tend to over-project the size of an epidemic wave; often over 60% of the susceptible population would be infected during a single wave. While many reasons for the over-projection were considered, from a lack of data and information to the assumptions that no public health interventions were incorporated in the projections, counter arguments abound. This has not only impacted public's confidence in the modeling in general, and also caused much confusion and frustration among the modelers, leading to claims that our standard epidemic models are great for underlying dynamics but simply have no predictive power.

Are there mathematical insights that can explain the observed over-projections? As it turns out, there is a mathematical explanation that our standard epidemic models, from simple to complex, deterministic to stochastic, will over-project the size of an epidemic wave. I will show that the well-established final-size formula, which links the basic reproduction number  $R_0$  to the final size of an epidemic, predicts that over 60% of the population will be infected during an epidemic with  $R_0$  around 2.

In addition to the problem of over-projection, I will also touch on other pitfalls in the modeling process that can impact the accuracy and reliability of model projections, including mismatching model outputs to data, mistaking model calibration with model validation, and unidentifiability issues in model parameter estimation. In the last part of the talk, I will demonstrate that incorporating human behavioural changes into epidemic models is a key to improve model accuracy and reliability of model projections. Level of mathematics is kept at minimum and the talk is aimed at a general audience.

University of Wyoming | [uwyo.edu](http://uwyo.edu)

**GO FOR GOLD**

FISK SPEAKER SERIES 2022