

## MfPH International Collaborative Summer Program in Nonlinear Differential Equations with Applications

**Title of the talk: Delay differential equation in cooperating behavior adaptation to perceive the infection risk.**

**Speaker: Mina Shafadeh**

**Date: August 12, 2024, at 10:30 AM-11:30 AM**

**Location: Kinsmen Building, York University: Room # 277**

**Abstract:** The COVID-19 pandemic has driven the adoption of wastewater-based surveillance, enabling public health authorities to monitor the epidemic by tracking SARS-CoV-2 genetic material in sewage shed by infected individuals. This surveillance method reveals a linear relationship between wastewater viral concentrations and infected cases.

To understand recurrent outbreaks of emerging infectious diseases, we developed a mathematical model that demonstrates how population behavioral adaptation, informed by wastewater reports, and delays in both behavior change, and wastewater reporting can lead to recurring outbreak patterns. Our transmission dynamics model, coupled with the renewal equation for disease transmission effective contacts, incorporates critical parameters: delays in population behavior change and wastewater reporting.

Our findings indicate that when the delays in behavior change implementation and wastewater reporting reach a critical threshold, infection numbers begin to oscillate around equilibrium. This pattern was observed globally during the early phase of the COVID-19 pandemic before variants of concern emerged. Our model and analyses offer a partial explanation for these observations, providing insights into managing emerging infectious diseases through improved surveillance and timely public health responses.

### The Speaker:



Mina Shafadeh

[Mina62@yorku.ca](mailto:Mina62@yorku.ca)

The speaker is a PhD student at York University under the supervision of Dr. Jianhong Wu. She received her MS in Applied Mathematics (Numerical Analysis) from Iran University of Science and Technology in 2008. Her master thesis focused on Numerical methods for solving functional integral equations. She obtained her second Master of Arts (Applied Mathematics) from York University in 2019.