Comprehensive Research Experience for Medical Students (CREMS)
2022 Supervisor and Project Information Form

Please complete and return via email ONLY to crems.programs@utoronto.ca by February 18, 2022.

Supervisor Information

NOTE: CREMS will not support pre-determined pairings of students and supervisors. Supervisors must agree to open their projects to all students and interview all that are interested.

Name: Girish Kulkarni
Email: girish.kulkarni@uhn.ca

Department: Division of Urology, Department of Surgery
Hospital/Research Institution: Princess Margaret Cancer Centre

SGS Department(s) (if applicable):
Institute of Health Policy, Management and Evaluation

ORCID ID (see https://orcid.org/ - If you do not have an ORCID ID we encourage you to sign up for one):
0000-0002-6929-6124

Location of Work:
Toronto General Hospital, Princess Margaret Cancer Centre

Field of Research (up to 4 keywords):
Bladder cancer, artificial intelligence, machine learning, survival analysis, forecasting

Student contact time (number of hours per week YOU are available to the student for any concerns or to review progress):
4 hrs/week
Project Information

NOTE: If this project is selected, this information will be posted on CREMS website for interested student applicants to view research opportunities.

PROJECT TITLE:
Development of an early warning system for tumour recurrence and progression in non-muscle invasive bladder cancer patients using time-series forecasting with artificial intelligence

PROJECT DESCRIPTION:
Including background, aim(s), method(s) and significance of the project. Maximum 300 words.

Majority of newly diagnosed bladder cancer cases are non-muscle invasive bladder cancer (NMIBC), which typically confers a favourable prognosis. However, up to 15% of these patients will progress to higher stages of disease. These patients have worse cancer-specific survival and often require major extirpative surgery which is associated with significant morbidity and mortality. Therefore, accurate and timely prediction of patients at risk of tumour recurrence and progression remains the cornerstone of management and counselling for patients with NMIBC.

Several predictive models have previously been developed to estimate the risk of recurrence and progression, however, they are not reflective of the current standard of care and perform poorly on external validation. Emerging evidence has shown that risk of recurrence and progression evolves over time, necessitating the role of dynamic prognostication with bladder cancer survivorship. However, no studies have explored the use of longitudinal data, including subsequent follow-up information and tumour recurrences, to provide a more personalized approach to predicting NMIBC outcomes.

We hypothesize that unifying longitudinal data with artificial intelligence (AI) approaches will improve predictive accuracy of NMIBC recurrence and progression when compared to conventional nomograms. The project aims will be twofold. First, we will develop time-series forecasting models using longitudinal data and AI to predict NMIBC recurrence and progression. The proposed AI models will integrate clinical, pathological, radiological, and cystoscopic information captured throughout each patient’s treatment history. Second, we will compare the diagnostic performance, calibration, clinical utility, and fairness of the AI models against conventional nomograms widely used in clinical practice.

To date, no models integrating the complete oncological timeline to predict NMIBC outcomes exist. Therefore, the results of this project are clinically important to better inform personalized NMIBC management, patient counselling, and identifying individuals that may benefit from more aggressive upfront treatment.

Is this project remote-capable (in case of new restrictions) or have an alternative remote option?
☒ Yes, remote capable  ☐ No
☐ Yes, alternate remote option. Please specify (100 words max): Click or tap here to enter text.

If human subjects are involved, have the appropriate Research Ethics Board approvals been obtained?
☐ Yes  ☐ No  ☒ Not Applicable

If yes, please list the application submission date:

Do you expect this work will be published?
☒ Yes  ☐ No  ☐ Uncertain / Other
Research Environment and Student Roles and Responsibilities

Please be specific as possible. Please describe the research environment, including availability of required facilities/equipment/expertise, supervisor’s experience and mentorship plans. Please clearly outline the student role(s) and responsibilities related to the project, potential educational value, and indicate who will serve as the student’s direct report for daily oversight (PI, PHD student, technician, etc.). **Maximum 300 words.**

This project will be conducted under the supervision of Dr. Girish Kulkarni, a urologic oncologist at the Princess Margaret Cancer Centre with a clinical focus in bladder and prostate cancer. He is also a clinical epidemiologist who runs a well-established laboratory that focuses on the epidemiology of genitourinary malignancies, including population-level quality of care, quality of life, health economics, and the efficacy of clinical evaluation and treatment towards prostate and bladder cancer. In this role, he has directly supervised trainees at all levels including medical students, residents, and fellows.

The applicant will have a dedicated workspace within Dr. Kulkarni’s laboratory, and protected time for bi-weekly progress meetings with the team. Specific to this project, the applicant will have full access to the institution’s bladder cancer database. A dedicated biostatistician associated with the Division of Urology will be available to assist with statistical analyses.

The applicant will work closely with one of Dr. Kulkarni’s Surgeon Scientist Training Program trainees, Dr. Jethro Kwong, who will provide day-to-day mentorship in both clinical and technical aspects relating to the project. The applicant will be exposed to the bladder cancer clinic at the Princess Margaret Cancer Centre and develop an understanding of the current standard of care for non-muscle invasive bladder cancer. The applicant will assist Dr. Kwong in developing and refining an AI model for the proposed project. As part of this studentship, the applicant will also receive regular seminars by Dr. Kwong to gain a broad exposure to urology and an introduction to AI. Additional opportunities to shadow Drs. Kulkarni and Kwong in the cystoscopy clinic will be available. Overall, the applicant will be well supported in all aspects of this project and develop a strong foundation in both urology and AI concepts.