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: Victoria McCredie
Email: Victoria.McCredie@uhn.ca

Department: Interdepartmental Division of Critical Care Medicine

Hospital/Research Institution: University Health Network - Toronto Western Hospital

SGS Department(s) (if applicable):
IHMPE

ORCID ID (see https://orcid.org/ - If you do not have an ORCID ID we encourage you to sign up for one):
https://orcid.org/0000-0002-1590-2846

Location of Work:
Work remotely - UHN

Field of Research (up to 4 keywords):
Neurocritical care, acute brain injury,

Student contact time (number of hours per week YOU are available to the student for any concerns or to review progress):
Daily for up to 1 hour. On my clinical weeks in the ICU I will only be able to meet once that week for an hour (or through email that I will answer at night once I finish my clinical duties)
**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:**
Application of Machine Learning to Predict Neurological Deterioration in Critically Ill Patients: A Systematic Review

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

**Aim:** The objective is to determine whether machine learning models, compared to human intelligence, more accurately predict neurological deterioration (seizures, stroke, intracranial hypertension) in critically ill patients.

**Methods:** Systematic review and meta-analysis design. A search will be conducted using key electronic databases. We will extract various features such as type of prediction model used, patient population descriptors, variables used in model, prediction window length, validation set type, pooled sensitivity and specificity, positive likelihood ratio (PLR), negative likelihood ratio (NLR), and diagnostic odds ratios (DORs) will be calculated for each included study. Quality assessment using either the MI-CLAIM checklist or the CONSORT-AI extension for clinical trial reporting for interventions involving artificial intelligence.

**Significance:** One of the fundamental challenges intensivists face in the care of the critically ill is the management of a huge amount of information gathered from patients. Intensive care environments are equipped with electronic information systems, hundreds of individual elements of structured information are collected every day in electronic charts, including vital signs, basic and advanced systemic and brain monitoring records, laboratory data, medications and their administration, and nursing records. The processing and the analysis of the large amount of patient-related information stored in clinical databases are beyond normal human cognitive ability. It is impossible for the human brain to fully assimilate this abundance of data, so one of the fundamental qualities an intensivist must learn is to know how to prioritize and filter the most relevant information for a given patient. Machine learning technology uses different methodologies to identify patterns from the data which typically involve either classification or event prediction. Critical care is particularly well suited for machine learning because technology and the data coming from technology are a large component of the care provided in the ICU. This research project will highlight the potential AI has in aiding the clinician in providing neurocritical care, particularly the early prediction of neurological deterioration from raised intracranial pressure, seizures, and stroke.

**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.

Research environment: Research students will work remotely (due to COVID restrictions in ICU), but they will have access to appropriate facilities to support their work, including those available electronically e.g., virtual remote desktops, online screening and data extraction tools to perform the systematic review, and virtual research lab meetings. Dr. McCredie (supervisor) is a tutor for the Evidence Synthesis: Systematic Reviews and Meta-Analysis course at the Institute of Health Policy, Management and Evaluation at the Dalla Lana School of Public Health, research students will learn how to critically appraise medical literature and study design, how to systematically review available evidence from randomized controlled trials, observational studies or diagnostic tests. Our UHN Information Specialist who works with Dr. McCredie’s research team will work with the research student to develop a robust search strategy and literature search for the systematic review. They will also provide in-depth individual training sessions and clinical librarian support. Students will also have the opportunity to present their ongoing work at our weekly virtual UHN critical care research rounds to discuss their research while being immersed in our interprofessional research group including clinician scientists and investigators, critical care residents and fellows, and doctoral students.

Student responsibilities: Student(s) will be involved in 1) creating a robust search strategy with our information specialist for the systematic review, 2) conducting a systematic review of ML models applied in neurocritical care, and 3) helping draft the final manuscript for knowledge translation. Student(s) will lead the screening of titles and abstracts, piloting of data collection forms, and abstraction of data from full-text manuscripts. They will assess methodological quality, bias, and reporting of ML studies in neurocritical care medicine using an easy-to-use appraisal tool to assess whether ML model developers have identified and mitigated bias. Students will be expected to write a scientific abstract of their results to present at the University of Toronto Research mini-conference and submission to at least one national and international medical conference.