Title of Research Project: Statistical Methods for Daily Mortality and Multiple Environmental Risk Factors

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Name, affiliation, and contact information for the supervisor and co-supervisor

Supervisor: Cindy Feng

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Abstract

This position involves collaborative research with statisticians and epidemiologists, with the goal of publishing in top-ranked journals. The successful candidate will work with Dr. Cindy Feng (Dalhousie University) and Dr. Meredith Franklin (University of Toronto) as co-supervisors. The successful candidate will be developing Bayesian methods for estimating the health effects of mixtures of environmental exposures. Methodological innovations to be considered include developing Bayesian models for estimating mixture weights of environmental exposures and health outcomes that are related via a nonlinear function and approximate Bayesian inference methods.

Interdisciplinary/Applied Experience

The major output of this research project is the bcGAIM, and its motivating application is the AQHI. The successful application will work with Health Canada, who is providing Cana-dian mortality data, to develop these outputs. The bcGAIM should be developed so that the collaborators at Health Canada can interpret its results and how the chosen priors impact its results. Therefore, this project places a strong emphasis on the candidate's communication skills, as they will be working with Health Canada during model development and must be able to communicate the output of the bcGAIM to many different stakeholders. While develop-ing the bcGAIM is nominally a modeling task, it places a strong emphasis on communication during model development. This is an important aspect of the PDF's training, as developing models in collaboration with others and communicating modeling results are valuable skills for the PDF's future career. The collaborators at Health Canada are well suited for mentoring the PDF through developing the bcGAIM and AQHI. They have both the technical expertise in re-gards to the AQHI, and the skills and experience to guide the PDF through any communication challenges.

Teaching/Training/Education

The teaching component consists of two activities. One is teaching two one-semester course in applied statistics (one per year), and the second is developing online materials for an applied statistics course. These two activities are designed to work together. In teaching these course, the PDF will be interacting with students during lectures, and providing them feedback in many different ways, such as 1-on-1 (e-mails, office hours, marking) and 1-to-many (during lectures). Some of these, such as exam assessments, are formal while others are informal. Guiding students through this course will develop the PDF's teaching and mentoring skills.

Developing online materials for use in an applied course is an excellent way for the PDF to reflect on their teaching experience, and produce materials that address the feedback that they received from students. They will be developed in collaboration with an experienced instructor. By working through the course curriculum and developing these materials, the PDF will be able to critically reflect on their experience in teaching the course.

Mentoring of the Postdoctoral Fellow

A number of different tools will be used to mentor the PDF. There will formal meetings with both supervisors, held at regular intervals throughout the year to provide feedback on their progress-to-date. There will also be weekly meetings held to more regularly discuss research progress. In addition, there will be other informal methods of providing feedback to the PDF. There are, in addition to receiving feedback on documentation (papers and reports) and presentations (oral and posters). This feedback will be provided by both supervisors as it pertains to their expertise, and it allow the PDF to develop independent research and communication skills for their own careers.

In addition, the PDF will receive the opportunity to pursue "stretch opportunities", such as additional research opportunities that will naturally arise from the collaborations with Health Canada and CGHR. These opportunities will build the PDF's ability to identify research that relevant to their own, and help build the network of researchers they have collaborated with. The supervisors will be involved in these collaborations. They will also provide advice on possible career opportunities, including resume and interview preparation. The Dalhousie University and University of Toronto are both excellent institutions to host this project, as they both have strong statistical and epidemiological activities.

A List of Qualifications of Suitable Candidates

- A doctoral degree in Statistics, Biostatistics, or a related area.
- Knowledge of Bayesian statistical methods and modeling – Bayesian time series, hierarchical modeling, Gaussian processes (random walks), and prior elicitation and specification.
- Proficiency with R, Stan (rstan), and INLA.
- Time management skills and the ability to meet competing deadlines.
- Excellent written and oral communication skills.
- Previous experience in collaborative health research is an asset.

Proposed Schedule for the Postdoctoral Fellow

Year 1: Dalhousie University, Halifax

- February 2022 - March 2022

    - Meet with Health Canada to collect their feedbacks on the idea of bcGAIM
    - Obtain the Canadian mortality data from Health Canada and download the air pollution data from Air quality monitoring networks
    - Clean and link the data

- April 2022 - November 2022

    - Develop bcGAIM and the R package
    - Draft the first manuscript on bcGAIM
    - Present the first manuscript at SSC or JSM conference
    - Develop the online teaching materials for an applied statistical course and mentoring graduate students in project-based studies.

- December 2022 - January 2023

    - Complete the first manuscript on bcGAIM
    - One day group meeting with collaborators and stakeholders from Health Canada

Year 2: University of Toronto, Toronto

- February 2023 - April 2023

    - Incorporate Latent Gaussian near-monotone smoothing into R package
    - Incorporate Non-Gaussian monotone smoothing into R package
    - Develop Penalized complexity priors for bcGAIM beta version software

- May 2023 - November 2023

    - Develop INLA algorithm alpha version R package
    - Complete the second manuscript on bcGAIM
    - Present the second manuscript on bcGAIM at SSC or JSM conference
    - Teach an applied statistical course

- December 2023 - February 2024

    - Send the second manuscript to Health Canada for approval
    - One day group meeting with collaborators and stakeholders from Health Canada