The impact of high resolution spatiotemporal environmental data on healthcare decision making at the hospital trust scale

Highlights

- Developing skills in analysis and synthesis of big data sets from earth observation and health
- Applying statistics to interdisciplinary problems in environment and health with the aim of improving healthcare
- Working with a major industrial partner in healthcare analytics

Overview

There is considerable evidence of the long term health impacts of sustained environmental exposures such as air pollution [1], and of short term health impacts of exposures such as extreme air pollution events [2] or temperatures [3]. However, there is little understanding of the interplay between long and short term exposures and patient medical history at the hospital trust scale, and how environmental data might be used within hospital trust analytics systems to improve care of the local population. Understanding these relationships could help improve knowledge of exposure responses in the local environment and population, lead to innovative commercial solutions for healthcare analytics, and improve patient healthcare, in particular for chronic respiratory conditions such as COPD.

This CASE studentship will explore statistical, data science, and Earth observation approaches to addressing the multidimensional problems which must be solved in order to provide meaningful environmentally-driven healthcare advice at the hospital trust scale. It will apply spatiotemporal data analysis and statistical modelling methods, and propose approaches for dealing with environmental data in a healthcare informatics system. Air pollution and meteorological data will be analysed, along with anonymised respiratory health data accessed through approved channels.

The student will engage with the Population Health Europe team at Cerner UK Ltd. This will enable a highly novel approach to the science of the PhD, and conducting this research in partnership creates potential for delivering added value to hospital trusts and their patients.
The figure shows one example of the kind of data that will be interrogated. Note that while visually air pollution and hospital admissions vary similarly and it may appear that the first drives the second, annual cycles related to season are largely responsible for variations in both. Respiratory admissions due to acute bronchitis peak very regularly in the middle of winter in England and Wales, typically between 25 December and 15 January, while admissions due to influenza-like illness peak more variably [4]. Air pollution levels also tend to increase in winter when atmospheric mixing is reduced. So there are very interesting statistical questions to consider to understand relationships among health and environmental data patterns.

Methodology

Environmental data including air pollution and meteorological data will be acquired from modelled and observational sources at spatial and temporal resolutions relevant to hospital trust scale decisionmaking. These data will be explored as potential explanatory variables for emergency respiratory hospitalization data as response variables. Health data in the first instance will be daily aggregated admissions at hospital trust scale. Modelled and measured air pollution data including fine (PM2.5) and course (PM10) particulate matter, nitrogen dioxide (NO₂) and ozone (O₃) will be considered first, along with air temperature data.

Figure 1 shows an example one-year time series of nitrogen dioxide (NO₂) measurements in Leicester and aggregated emergency respiratory admissions in University Hospital Trust Leicester. Aggregated emergency respiratory admissions data will be analyzed along with a variety of environmental variables. Statistical modelling and machine learning approaches will be applied to identify relationships. Finally, a prototype environmental healthcare analytics approach will be developed.

Further Reading


Funding

This research project is one of a number of projects in the Department. It is in competition for funding with one or more of these projects. Usually the project which receives the best applicant will be awarded the funding.

Home/EU Applicants

This project is eligible for a fully funded College of Science and Engineering studentship which includes:

- A full UK/EU fee waiver for 3.5 years
• An annual tax free stipend of £14,777 (2018/19)
• Research Training Support Grant (RTSG)

International Applicants
This project is eligible for a fully funded College of Science and Engineering studentship which includes:

• A full international fee waiver for 3.5 years
• Research Training Support Grant (RTSG)

Application Instructions
The online application and supporting documents are due by Monday 21st January 2019.

Any applications submitted after the deadline will not be accepted for the studentship scheme.

References should arrive no later than Monday 28th January 2019.

Applicants are advised to apply well in advance of the deadline, so that we can let you know if anything is missing from your application.

Required Materials
  1. Online application form
  2. Two academic references
  3. Transcripts
  4. Degree certificate/s (if awarded)
  5. Curriculum Vitae
  6. CSE Studentship Form
  7. English language qualification

Applications which are not complete by the deadline will not be considered for the studentship scheme. It is the responsibility of the applicant to ensure the application form and documents are received by the relevant deadlines.

All applications must be submitted online, along with the supporting documents as per the instructions on the website.

Please ensure that all email addresses, for yourself and your referees, are correct on the application form.

For more information, please visit our website at:
https://www2.le.ac.uk/colleges/scieng/research/postgraduate-opportunities/cse-2019/instructions