Title of PhD project / theme	**Epidemiological investigation of environmental risk factors using big data methods**
Supervisory team	Antonio Gasparrini (LSHTM, Lead) Chris Fook Sheng Ng (Nagasaki University) Ana Maria Vicedo-Cabrera (University of Bern / LSHTM) Masahiro Hashizume (University of Tokyo / Nagasaki University)
Brief description of project / theme	Development of big data technologies especially in the past couple of years have offered tremendous opportunities to advance the ways researchers investigate health impacts of environmental factors such as air pollution and extreme temperature. Yet, the handling of these novel big data resources requires development of high-level quantitative skills and state-of-the-art analytical methods apt for managing and manipulating large complex datasets. This PhD project aims at extending the current epidemiological research on environment-health associations using large data resources, including those with longitudinal health profiles and individual measurements from established electronic health records and study cohorts, and the high-resolution spatio-temporal maps of ambient exposure such as air pollution and temperature available from ground and space surveillance technologies. These large data resources offer high-resolution exposure information and rich individual level data, which enable novel investigations of complex aetiological mechanisms and spatial-temporal variation of risk/vulnerability using cutting-edge epidemiological study designs and statistical methods developed and applied by the supervisors. Related publications: 1) Sera F, Amstrong B, Blangiardo M, Gasparrini A. An extended mixed-effects framework for meta-analysis. *Statistics in Medicine*. 2019. Link 2) Vicedo-Cabrera AM, Sera F, Gasparrini A. Hands-on tutorial on a modeling framework for projections of climate change impacts on health. *Epidemiology*. 2019;30(3):321-329. Link 3) Gasparrini A, Scheipl F, Armstrong B, Kenward MG. A penalized framework for distributed lag non-linear models. *Biometrics*. 2017;**73**(3):938-948. Link 4) Lopez Bernal J, Cummins S, Gasparrini A. Interrupted time series regression for the evaluation of public health

	interventions: a tutorial. *International Journal of Epidemiology*. 2017;46(1):348-355. Link 5) Gasparrini A. Modelling lagged associations in environmental time series data: a simulation study. *Epidemiology*. 2016;27(6):835-842. Link More at: http://www.ag-myresearch.com/publications.html
The role of LSHTM and NU in this collaborative project	The LSHTM team will assume the leading role in the development of the state-of-the-art epidemiological methods. Support and resources are also accessible through the Centre for Statistical Methodology at LSHTM (https://csm.lshtm.ac.uk/). Together with the Nagasaki University (NU) team, both institutions will work together on data preparation, study design, analysis and the dissemination of findings. Important benefits of the project include scientific knowledge and contributions through novel applications of big data methods in environmental epidemiology. Mode of collaboration: Antonio Gasparrini (LSHTM) will lead the supervisory team and coordinate with Chris Fook Sheng Ng (NU) to work closely with Ana M. Vicedo-Cabrera and Masahiro Hashizume to train student and oversee the project to completion. Advisory committee may be identified later depending on subject matter.
Particular *prior* educational requirements for a student undertaking this project	The candidate should have a quantitative background (e.g. MSc in Medical Statistics, or Health Economics or Epidemiology with equivalent level of quantitative content), and prior training in epidemiology. Experience in GIS, spatial analysis, time series modelling, and statistical computing using R/Python is desirable.
Skills we expect a student to develop/acquire whilst pursuing this project	The student will develop high-level quantitative skills in data analysis and regression modelling, in particular in the analysis of complex and large datasets. At the end of the PhD, the student will learn sophisticated statistical methods, such as spatio-temporal modelling, regression analysis, and statistical computing, widely applicable in a variety of research areas beyond environmental epidemiology. The student is also expected to gain experience to facilitate translation of epidemiological evidence into decisions for risk management, and be able to develop interdisciplinary skills linking health research and public policy.
Title of PhD project / theme	**Climate change health impacts and adaptations: drivers and projections**
Supervisory team	Antonio Gasparrini (LSHTM, Lead) Chris Fook Sheng Ng (Nagasaki University) Ana Maria Vicedo-Cabrera (University of Bern / LSHTM)

	Masahiro Hashizume (University of Tokyo / Nagasaki University)
Brief description of project / theme	Climate change affects health through complex interplays of weather and population-related factors. Identifying the underlying drivers that modulate these associations will contribute to understanding climate change vulnerability and the potential adaptation mechanisms. Evidence will be essential to provide reliable projections of health impacts due to climate change under specific adaptation and mitigation scenarios. This PhD project aims to develop a methodological framework (1) to identify the main drivers of adaptation to climate change, and (2) to quantify climate change impacts in terms of temperature-mortality projections under composite scenarios of mitigation and adaptation. The project entails the use of cutting-edge statistical methods to derive future temperature-mortality associations based on changes in potential drivers of vulnerability, defined by the alternative trends in socio-economic development and adaptation strategies. The proposed PhD work will benefit from the massive datasets collected for epidemiological analyses on climate and health through the Multi-City Multi-Country (MCC) network, encompassing more than 500 cities/communities across 29 countries. The student will be exposed to state-of-the-art epidemiological designs and statistical methodologies in environmental health research. There will be training and research opportunities that will equip the student with high-level quantitative skills. Related publications at: http://mccstudy.lshtm.ac.uk/publications/
The role of LSHTM and NU in this collaborative project	The existing MCC network led by LSHTM in collaboration with the Nagasaki University (NU) researchers will lay the foundation and provide important expertise to the project. Additional support and transdisciplinary resources are accessible at the new Centre on Climate Change and Planetary Health at LSHTM (https://www.lshtm.ac.uk/research/centres/centre-climate-change-and-planetary-health). The leading role of the two institutions in global health provides the advantage of wide-reaching impacts. Both institutions will work together on project implementation and the dissemination of findings, and stand to benefit from contributions to high priority research topics. Mode of collaboration: Antonio Gasparrini (LSHTM) will lead the supervisory team and coordinate with Chris Fook Sheng Ng (NU) to work closely with Ana M. Vicedo-Cabrera and Masahiro Hashizume to train student and oversee the project to completion. Advisory committee may be identified later depending on subject matter.

Particular *prior* educational requirements for a student undertaking this project	The candidate should have a quantitative background (e.g. MSc in Medical Statistics, or Health Economics or Epidemiology with equivalent level of quantitative content), and prior training in epidemiology. Experience in advanced time series regression modelling, meta-analytical technique, and R statistical software is desirable.
Skills we expect a student to develop/acquire whilst pursuing this project	The student will develop high-level quantitative skills in data analysis and regression modelling, in particular in the analysis of complex and large datasets. At the end of the PhD, the student will master sophisticated statistical methods, such as impact projections analysis, regression analysis, and statistical computing, potentially applicable in various research areas within beyond environmental epidemiology. The student is also expected to gain experience to facilitate translation of epidemiological evidence into decisions for risk management, and be able to develop interdisciplinary skills linking health research and public policy.