Research Project Proposal

Project Title

Multi-level modelling of international variations and time trends in asthma and allergic diseases in children and adults.

Background

“Asthma is a common chronic non-communicable disease that affects as many as 334 million people of all ages in all parts of the world. It is a cause of substantial burden to people, often causing a reduced quality of life, not only due to its physical effects, but also its psychological and social effects.” “Asthma is a particularly serious burden in low- and middle-income countries least able to afford the costs.” As reported in the Global Asthma Report 2014.

The ISAAC project (International Study of Asthma and Allergies in Childhood) has been running since 1992. Phase I provided the first population-based assessment of the prevalence and severity of asthma and allergic diseases among children.

With additional country level data on environmental factors they were able to identify population level associations between asthma prevalence and Gross National Product, smoking, trans-fatty acids and immunisations among other things (Asher, Stewart et al, 2010).

To expand on this, Phase III measured changes in symptoms of asthma, rhinoconjunctivitis and atopic eczema across multiple countries between 2001-2002 and included exposures to environmental factors at individual level and genetic markers.

Results show a narrowing of the gap between wealthy and poorer countries:
“International differences in asthma symptom prevalence have reduced, particularly in the 13–14 year age group, with decreases in prevalence in English speaking countries and Western Europe and increases in prevalence in regions where prevalence was previously low.” “The increases in asthma symptom prevalence in Africa, Latin America and parts of Asia indicate that the global burden of asthma is continuing to rise, but the global prevalence differences are lessening.” (Pearce, Aït-Khaled et al, 2007).

There have been no more international surveys on this scale since 2003 but there is still more to be learned from the phase III ISAAC data.

Project Aims

The ISAAC organisation has evolved into the Global Asthma Network, and a new phase of data collection - GAN Phase I is now commencing. Each centre will be invited to undertake a survey using the GAN protocol and questionnaires. Two age groups of children will be involved (13-14 year olds and 6-7 year olds), as well as parents/caregivers of each child. The adolescents and the parents of the children will be asked to complete questionnaires based on ISAAC, including additional questions on asthma management and the environment; for the adults, questions will be based on the European Community Respiratory Health Survey.

Participants will be selected from randomly sampled schools within a specified geographical area (or all schools) around each study centre. Within each country at least one urban and one rural centre will be sought so that the different influences of these environments on asthma can be explored. A sample size of 3000 per age group per centre will be used to give sufficient power to detect differences in the severity of asthma. For smaller populations, such as a small island nation, all pupils (and their parents/ caregivers) of the age group will be selected.

I would like to assist in the design and creation of the new dataset, using skills honed working with large Sas datasets and data warehouses within the [removed] services industry. I will then use it in combination with the previous ISAAC dataset to

- examine prevalence patterns and risk factors over time, by country, by centre, and in individuals by using the available exposure data at both individual and centre levels
- Compare countries with different public health policies to identify interventions that work
- Examine time trends for asthma prevalence using complex statistical analysis
- Develop methodologies for complex multi-level modelling of data containing multiple exposures, ages, centres, regions and time points

This project aligns well with the following MRC themes:

- quantitative skills for large datasets
- evaluating complex interventions theme

I would expect the results of this project to be useful to public health officials within multiple countries. Understanding the important risk factors at different levels improves the ability to positively impact the prevalence of asthma and other allergic diseases through changing health policies. Outcomes will vary widely from country to country and this work will help estimate the impact of potential policy changes.

In addition, any methodological developments will be of use to statisticians working in other areas of health research with similarly structured complex datasets.

Research Timeline

Year 1

- Design and data management of complex multi-level dataset for GAN data ready to integrate with existing ISAAC data.
- Systematic Review of studies in asthma, rhinoconjunctivitis and eczema causes.
- Training in mechanisms/biology of asthma and allergies.
- Attend relevant conferences e.g. British Society of Allergy & Clinical Immunology Annual Meeting.
- Short courses/modules in Causal Inference, Propensity Scores and Multiple Imputation.
- Begin analysis of phase III ISAAC dataset.

Year 2

- Complete analysis of phase III dataset using multi-level modelling techniques.
- Analysis of GAN dataset.
- Comparison of different modelling strategies.
- Placement or Internship

Year 3-3.5

- Full analysis of the combined GAN and ISAAC datasets using multi-level modelling techniques identified in year 2.
- Synthesize findings and write up thesis.

References

Global Asthma Network: *The Global Asthma Report 2014* http://www.globalasthmareport.org

Asher MI, Stewart AW, Mallol J, Montefort M, Lai CKW, Aït-Khaled N, Odhiambo J, and the ISAAC Phase One Study Group. *Which population level environmental factors are associated with asthma, rhinoconjunctivitis and eczema? A review of the ecological analyses of ISAAC Phase One.* Respiratory Research. 2010; 11:8.

Neil Pearce, Nadia Aït-Khaled, Richard Beasley, Javier Mallol, Ulrich Keil, Ed Mitchell, Colin Robertson, the ISAAC Phase Three Study Group. *Worldwide trends in the prevalence of asthma symptoms: phase III of the International Study of Asthma and Allergies in Childhood (ISAAC)* Thorax. 2007 September; 62(9): 758–766.