A SPATIAL MICROSIMULATION MODEL OF CO-MORBIDITY: FIRST RESULTS

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Much modelling in the social sciences takes an aggregate or meso-level approach.

However, all government policy and investment has a spatial impact, regardless of the initial motivating factor.

As such, policy level analyses call for individual or household level analysis at a disaggregated/local spatial scale.

- Particularly Health Policy
- Health is a produce of individual and social factors that vary geographically
Project Overview & Goals

Develop a model of **co-morbidity** between CVD, diabetes & obesity **at a small area level for England**

- Identify the underlying **determinants of co-morbidity** for CVD, diabetes & obesity at both the national and health authority region in England using the HSE
- Using **spatial microsimulation**, develop baseline small-area population estimates of co-morbidity outcomes for England
- **Validate** the baseline estimates of health service utilisation associated with those co-morbidities using administrative data supplied by **East Kent Health Trust**
- **Inform health policy**, using East Kent as a case study area identifying areas of apparent under/over-utilisation
Non-communicable Diseases (NCD)

- In developed countries cardiovascular disease (CVD), diabetes and obesity are major contributors to the overall burden of chronic disease.
- In 2010, 48% of NCD deaths were caused by CVD, while diabetes was directly responsible for 3.5% of NCD deaths (World Health Statistics, 2012).
- Whilst; Approximately 1.5 billion of the global adult population are overweight (WHO, 2011).
- Along with an increased prevalence of CVD, diabetes and obesity as single morbidities.
- Growing body of evidence that individuals are increasingly at risk of two or more of these diseases.
Research on comorbidity

- Responding to increased rates of comorbidity and the knowledge that comorbidity significantly increases mortality rates and decreases functional status and quality of life, the study of comorbidity, has increased over the last decade:
  - Clinician led; focused on:
  - Identifying the most prevalent groupings of illnesses that demonstrate comorbidity, particularly among the elderly population
    - CVD: 2 of the major risk factors are obesity and diabetes
    - Close link between obesity and diabetes is well established
    - CVD is listed as the cause of death for 65% of persons with diabetes
  - Based on revealed preference; hospital admissions data
  - Standardised at best by age and sex
Goal 1 – Outcome Multinomial Logistic Model

- Identify the underlying determinants of co-morbidity for CVD, diabetes & obesity in England using the Health Survey of England
  - Gender and Marital Status significant, but not as influential as other variables (standardising by age and sex is therefore not sufficient)
  - Black population presents a high diabetes (and diabetes-related co-morbidity) risk
  - Asian population presents a high diabetes risk but low obesity (BMI threshold debate)
  - Lowest disease risk for individuals with a high income, owning their own home, in-work and having a degree
  - Obesity (and related) higher risk for ex-regular smokers but lower risk for smokers
Such a National focus...

- Ignores the accepted empirical evidence that an individual’s health is the outcome of multifaceted processes rather than age or initial health status alone (Morrissey et al., 2013).
- Ill-health is not only a product of aging, but instead individual level circumstances.

- Thus, this project assumes that similar to single morbidities, comorbidity is the result of complex interrelationships between differing health conditions and shared
  - Demographic,
  - Socioeconomic and;
  - Environmental risk factors
All of these factors are differentiated across different spaces.

And the HSE has very coarse spatial scales: SHA.
Goal 2 – Including Geography

- **UK – Very lucky, loads of data**

- **Data Issues**
  - Census data: Available at the small area level does not offer any information on household income
  - Survey data often contains detailed micro data, for example income, pensions and health data that is not included in the census - aspatial in nature

- Spatial Microsimulation offers a means of synthetically creating large-scale micro-datasets at different geographical scales.
Goal 2 – Including Geography

- Develop baseline small-area population estimates of co-morbidity outcomes for England using:
  
  **Spatial microsimulation**

- Combine data from:
  - Health Survey for England (HSE 2008-2011): Social Health Authority (SHA) spatial scale
  - Census of Population (CoP 2011, recent release):
  - Target Geography – Lower Super Output Area level (LSOA)
- Pre calibration Results...
- Non-Integer (Counts themselves should not change between integer and non integer)
Simulation Results

- Initial Validation (Pre-calibration)
- Used Self Report General Health as a variable for calibration at the MSOA Level
- Good match!
Overview for England

One Plus Disease

Two Plus Disease
Policy Implications

- In an effort to prevent worsening functional status, increasing dependence of care and the increased risk of mental and social problems.
  - Health care should shift its focus from specific diseases, to multiple pathologies
  - Single disease management approach is no longer suitable for a large number of individuals

- Furthermore, given the spatial inequalities observed interventions to reduce comorbidities should be geographically tailored to the unique risk profile and needs of high-risk communities.
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