Institution: University College London

Unit of Assessment: 2 - Public Health, Health Services and Primary Care

Title of case study: Translating epidemiological evidence on social inequalities to support the pensions industry.

1. Summary of the impact

Our research has used epidemiological insights, data and methods to enable Legal & General (L&G), a major pensions and annuity provider, to understand the drivers of long-term trends in the annual rates of improvement in mortality in older ages. Our first-ever analysis of inequalities in mortality trends by cause of death over 25 years in England, and future projections of these, has resulted in better informed pricing and risk management (capital reserving) practices at L&G. We also modelled how much of the decline in coronary heart disease, the main contributor to improving life expectancy, was due to improved healthcare versus healthier lifestyles. Projections of these, based on plausible scenarios of evolution of risk factors and disease management, helped strengthen the evidence base for L&G's assumptions of mortality improvements for the UK financial regulators.

2. Underpinning research

Since 2006, researchers at UCL's Department of Applied Health Research (DAHR), have led a programme funded by Legal & General, one of Britain's top FTSE 100 companies and a major pension provider in the UK insurance industry. The programme was set up to apply UCL's expertise in the field of social epidemiology to key questions underpinning mortality and longevity risk which are of interest to the UK actuarial profession. The overarching aims are: to analyse social inequalities in health and mortality risk in older age, between groups and over time; to identify the underlying drivers of longevity change; and to project future trends.

The Principal Investigators for this collaboration are Mr Joseph Lu at L&G and at UCL Professor Rosalind Raine. Dr Madhavi Bajekal and Dr Shaun Scholes (both L&G employees and honorary staff at UCL, and based at UCL) are the key researchers.

Over the four years to April 2013, we have focused on three streams of work:

Firstly, we used a policy model developed by Professor Capewell (Liverpool University) and extended in collaboration with him and his team to examine whether the **social gradient** in the differential falls in coronary heart disease (CHD) mortality in the UK were mostly due to improved healthcare treatments or to healthier lifestyles. We quantified the relative contributions of seven risk factors and approximately 50 medical therapies to the CHD mortality fall from 2000 to 2007 and the variations between socio-economic groups. This research is now complete, and key published papers are listed below **[1, 2, 3]**. To run this model, we assembled a unique database from sources including population health surveys, GP records, hospital admissions, specialist clinical audits, and mortality statistics – all of which were uniformly coded at the individual level to a deprivation index based on an individual's postcode of residence. This dataset will continue to be vital in the next phase of research from 2014.

Secondly, we compiled deprivation-coded mortality data from the Office of National Statistics (ONS) for each year from 1981 onwards to address key questions relating to long-term historical trends in rates of mortality improvements among people over 50 years old, by age, gender and socio-economic group. Such analyses had not previously been conducted for the UK; the closest is the linked-mortality analysis of participants in the ONS's Longitudinal Study – a one per cent sample of census records for individuals in England and Wales, linked between successive censuses since 1971. However, results from the latter are available only once every decade, and are indicative rather than conclusive due to the small sample sizes at older ages, particularly when

segmented by social position, age and gender. Our mortality analyses included the following:

a) age, period and cohort effects in rates of mortality improvement for different social groups. The results were presented at the Institute and Faculty of Actuaries (IFoA) and published in the industry's leading peer-reviewed journal, the British Actuarial Journal (BAJ) **[4]**

b) Cause of death decomposition of the differences in life expectancy at age 50 between social groups and over time. Presentation at the IFoA conference, Sept 2011 **[5]**

c) Gender differentials in life expectancy at older ages: are differentials converging over time at the same pace across social groups? What factors are contributing to the observed convergence over time? These analyses are in support of the EU Gender Directive, adopted across the UK in December 2012 **[6]**.

Thirdly, we have provided epidemiological intelligence and support to L&G. Demographers, epidemiologists and actuaries often approach the same question – e.g. longevity – in very different ways resulting in a gap of integrated knowledge across the spectrum. For example: there are numerous studies, replicated across several countries and cohorts, which show that marital status in old age is a strong predictor of longevity. But confusingly, the statistical methods used and effect sizes vary widely between studies. In such instances where good evidence exists, rather than carry out fresh analyses, we evaluated the evidence and converted these into practical 'best estimates' suitable for actuaries to use in longevity models, e.g. as a rating factor.

To supplement our in-house expertise, we have actively built academic collaborations across multi-disciplinary teams (e.g. with Liverpool University for clinical epidemiology and policy modelling; Leeds University and Max Planck Institute for demographic modelling; CASS for actuarial forecasting).

3. References to the research

[1] Bajekal M, Scholes S, Love H, Hawkins N, O'Flaherty M, Raine R, Capewell S. Analysing recent socioeconomic trends in coronary heart disease mortality in England, 2000-2007: a population modelling study. PLoS Med. 2012;9(6):e1001237. http://dx.doi.org/10.1371/journal.pmed.1001237

[2] Hawkins NM, Scholes S, Bajekal M, Love H, O'Flaherty M, Raine R, Capewell S. Community care in England: reducing socioeconomic inequalities in heart failure. Circulation. 2012 Aug 28;126(9):1050-7. http://dx.doi.org/10.1161/CIRCULATIONAHA.111.088047

[3] Scholes S, Bajekal M, Norman P, O'Flaherty M, Hawkins N, Kivimäki M, Capewell S, Raine R. Quantifying policy options for reducing future coronary heart disease mortality in England: a modelling study. PLoS One. 2013 Jul 25;8(7):e69935. http://dx.doi.org/10.1371/journal.pone.0069935

[4] Lu J, Wong W, Bajekal M. Mortality improvement by socio-economic circumstances in England (1982 to 2006). British Actuarial Journal, FirstView Articles, pp 1-35. Published online: 17 December 2012 http://dx.doi.org/10.1017/S1357321712000359

[5] Bajekal M, Scholes S, Blane D, Lu J, Raine R: Trends in social inequalities in old age life expectancy: *decomposition by age and cause of death* (England, 1982 to 2006). - http://www.actuaries.org.uk/research-and-resources/documents/c01-trends-inequalities-life-expectancy-age-65-england-socio-econom

[6] LSAP: Life expectancy: past and future variations by gender, England and Wales. Available at: http://www.longevitypanel.co.uk/docs/life-expectancy-by-gender.pdf

4. Details of the impact

Population ageing is a key social issue of our times. Not only do we need to understand the factors which have contributed to increasing longevity and how these may evolve; we also need to understand social differentials in patterns and trends to inform policy making.

The immediate beneficiary of our research is the pensions provider Legal & General (L&G). L&G provides retirement income to some 250,000 customers and has recently received several high-profile financial services industry awards, including: Best Life Assurance, Term Assurance, Protection and Critical Illness Provider, 2011 – Financial Advisor Life and Pension Awards; 4* winner in life and pensions category, 2011 – FT Adviser Service awards. The research has implications for the valuation of pensions across social groups e.g. public sector final salary schemes, occupational (defined contribution) schemes and privately funded pensions.

One of the important ways we support L&G is to translate published epidemiological evidence to meet their specific information needs in a practical way. Through engagement with UCL and DAHR seminars, L&G have also had the opportunity to hear 'first-hand' discussions on the changing needs, and matters relating to the provision of healthcare in the UK, especially in relation to major chronic diseases now and in the future. We also contribute to joint monthly seminars between UCL and L&G analysts to enable mutual knowledge transfer and capacity building. We have disseminated findings in discipline-relevant media and in industry forums: seminars, journals and magazines. A key outcome of the academic-industry collaboration is to achieve a collective view on the future evolution of health and longevity and to spur the development of a range of insurance and annuity products that are fair, affordable and could improve the quality of life of all in retirement

L&G report that direct benefits to them include:

[Text removed for publication] **[a]**.

Reputational benefits of the research to L&G are not easily measureable. One measure of impact is that the lead UCL researcher (Bajekal) is an invited member of the Institute and Faculty of Actuaries Mortality Research Steering Committee and contributed a features article to the profession's premier trade journal 'The Actuary' (see below).

All of the UCL/L&G research outputs are in the public domain, so the programme contributes indirect benefits to the pensions industry more widely. By filling the gap in public availability of socially segmented longevity risk analyses, including their epidemiological drivers via the medium of peer-reviewed publications, the pension industry gains by having an externally acknowledged benchmark against which to align company specific client portfolios and to project future trajectories based on a better understanding of the reasons for past differentials and the likely direction of travel.

Bajekal was invited to serve on the Institute and Faculty of Actuaries Mortality Research Steering Committee (MRSC) in Feb 2012. Since then, she has organised a thought leadership seminar **[b]** and presented a paper at the Institute's sessional research meeting **[c]**. She continues to be active in the profession's research strand and is on the scientific organising committee for the MRSC's bi-annual 2-day conference in September 2014.

The research also has a wider impact on social and health policy – for example, our research has been used by the ONS in their Statistical Bulletin on Avoidable mortality in England and Wales, 2011 **[d]**.

5. Sources to corroborate the impact

[a] A letter from the Head of the Longevity Risk team at L&G corroborating all the impacts mentioned above is available on request.

[Text removed for publication]

[b] Mortality Thought Leadership Seminar Series: 'Socieconomic inequalities in mortality and longevity', Staple Inn, 12th March 2013. http://www.actuaries.org.uk/events/one-day/mortality-thought-leadership-seminar-series-socioeconomic-inequalities-mortality-and-
'Mortality improvements by socio-economic circumstances, discussion paper" Lu, J, Won W, Bajekal M. Staple Inn, 11th Sept 2012. http://www.actuaries.org.uk/events/one-day/sessional-research-event-mortality-improvement-socio-economic-circumstances-england-1

[c] Bajekal, M. 'Longevity modelling: signs of maturity', The Actuary, 1st Oct 2012. http://www.theactuary.com/features/2012/10/signs-of-maturity/

[d] http://www.ons.gov.uk/ons/dcp171778_311826.pdf See references section.