- Pressure on public finances is moving the provision of welfare from the state to individuals and employers, needing private provision of protection products such as critical illness, income protection and life insurances.
- Rising wealth in developing countries with less comprehensive state health care provision.

Projections of future longevity could draw upon techniques from a range of fields, including statistics, medical science, epidemiology and demography. Population trends can also be broken down into subpopulations to examine mortality rates according to gender, socio-economic status or health condition. There are opportunities for actuaries to work with other disciplines to develop forecasting methods that take account of drivers of longevity and morbidity.

Matthew Edwards discussed his recent development of a disease-based Markov model simulating the mortality process through transitions from healthy to disease to death, or from other starting points. This has obvious uses in a medical underwriting context, but can also add insights in the field of longevity improvements. Through a pool of medical experts, the likely improvement trend for each transition (for instance, from healthy to diabetes, or from stroke to death) can be quantified with suitable rationale to allow proper discussion as to the suitability of the assumptions. The model then provides a framework to combine those trends across all diseases and all state transitions.

Matthew illustrated some of the results obtained from this work. For instance, the model was able to quantify the expected female mortality improvements as a proportion of male improvements (circa 60%–90% over a typical pensioner age range), and also able to segment the proportions of overall improvements attributable to improvements in morbidity as opposed to improvements in mortality from the disease state (the split was ~15% morbidity: 85% mortality).

Workshop sessions

Coherent mortality projections for the Netherlands taking into account mortality delay and smoking

Fanny Janssen, Population Research Centre, University of Groningen, the Netherlands

Recent analyses of mortality trends reveal a transition from mortality compression (a changing shape of the age-at-death distribution with more deaths occurring around the modal age at death) towards mortality delay (a shift in the age-at-death distribution towards older ages) (e.g. Janssen and de Beer, 2016). Mortality projections including this shift have been applied before, albeit very rarely, and only for single populations/countries. Also these mortality projections did not account for the effect of smoking, whereas smoking is known to greatly affect future mortality trends and levels (e.g. Janssen *et al*., 2013). Recently developed coherent mortality projections have not been applied much, let alone in combination with smoking and mortality delay.

The speaker proposed a mortality forecasting methodology which simultaneously takes into account the effect of smoking, mortality delay and mortality compression, and the mortality experience of the opposite sex and of other countries. She illustrated the methodology with a mortality forecast for the Netherlands. See Janssen & de Beer (2016) for more details.

For the Netherlands, the necessity of taking into account smoking when performing projections based on mortality delay clearly showed. That is, compared to all-cause mortality, for non-smoking-related mortality increases in the modal age at death – indicating mortality delay – are much more linear, and more similar for men and women. The coherent mortality projection for the Netherlands which took into account both mortality delay and smoking resulted in higher remaining life expectancy at age 40 in 2050 and more deaths at higher ages compared to a conventional (Lee–Carter) projection and the forecast by Statistics Netherlands. The Lee–Carter model seems not able to fully capture the (continued) delay.

Extreme scenarios for pandemic risk

Dr Gordon Woo, Catastrophist, Risk Management Solutions

Dr Woo gave a presentation on extreme scenarios for pandemic risk. He started by pointing out that it is almost a century since the last catastrophic influenza pandemic. The most recent influenza pandemic was also H1N1, and occurred in 2009. Because this was mild, there is a psychological outcome bias towards people downgrading pandemic risk as a cause of mass excess mortality.

Dr Woo stressed that in order to understand the scope of pandemic risk, the spectrum of possible future scenarios needs to be constructed based on the current human population and infectious disease environment. This structured approach to dynamic modelling is more insightful for risk management than a purely statistical method. Intrinsic to this approach is the maximal incorporation of medical and public health knowledge.

Of particular actuarial interest for life insurers are the extreme pandemic scenarios. A benchmark for a pandemic of insurance catastrophe proportions is the 1918 pandemic. Many more died of the influenza pandemic than in the Great War itself. Dr Woo made a special note, which is significant for risk assessment, that the two global disasters were causally connected. The influenza was brought to the western front by a cohort of 100,000 Chinese labourers despatched there by the Chinese government seeking favour from the western powers.

The nexus between political conflict and a global pandemic provides one clear route to disaster. Dr Woo was asked about current extreme scenarios of this kind. In response, he cited the counterfactual possibility in 2015 that an emerging Middle East respiratory syndrome outbreak in the Middle East might have developed into a pandemic through the migration of a million refugees into Europe. He also commented that it was fortunate there was no civil war in West Africa when Ebola struck in 2014.

Medical innovation versus Risk factors: a future perspective on breast and lung cancer

Nicola Oliver, Medical Director and Head of Longevity and Mortality Research, Medical Intelligence (UK) Ltd

The last 30 years have witnessed significant advances in medical treatments for some, but not all, cancers. Similarly, changes in lifestyle behaviour risk factors, both positive and negative, have