



Actuarial Research Centre

Institute and Faculty
of Actuaries

ARC Webinar Series 2017

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Questions from the Audience

We received a large number of questions over the course of the two webinars. Principal Investigator, Prof. Andrew Cairns, has answered a representative selection of these questions below.

What is the reason for the high mortality for 25 year olds in 1995?

The increase in mortality at age 25 after 1980 is most likely due to the HIV-AIDS epidemic.

Why is mortality in Denmark so high?

Much of this is due to lifestyle issues such as smoking, diet and alcohol consumption. Further back Denmark was in line with its neighbours, after which a gap opened up, and more recently they gap is closing again in a catch up phase.

How do you think your research could be applied to my own organisation?

It depends on what type of organisation you belong to. For a large insurer, reinsurer, our objective is to encourage institutions to use stochastic mortality models alongside stochastic economic scenario generators as part of an overall programme of good risk management. For smaller pension plans, the models might be used to generate a small number of stress tests or scenarios that can be applied to the preferred central mortality projection. We are more than happy to discuss these and other possibilities with anyone who asks.

What trends are you seeing for female mortality?

My collaborators in Denmark are still working on this. Broadly the patterns are a bit different compared to males. Additionally, though, the females' data by affluence are less well behaved amongst the lower affluence groups: in other words for a female, low affluence might not be as good a predictor of socio-economic status as it is for males.

The GNP per head in 2015 in was Japan £37K and it has low mortality, in the UK it was £43K with medium mortality and in Sweden is was £58K with low mortality. The Japanese have a secret! Do you know it?

Unfortunately I don't have a good answer for this, other than that the reasons will be quite complex. The broader link between life expectancy and GDP is well known. E.g. Google "life expectancy versus GDP" and click on images, and you will see some interesting plots.

How do you measure "wealth" in the case study?

Approximately, wealth includes personal savings plus other assets such as property minus loans.

Some of the covariates could change over time (e.g. affluence, health information) - how do you allow for this in your model?

Some of this is work in progress. E.g. for affluence, the group to which an individual is allocated is fixed at retirement age. Before retirement individuals can and do change groups depending on personal circumstances. The work to be done here is to see how often people switch groups, and given a current group allocation, what group are they likely to end up in at retirement age. This last question is important for valuing deferred annuities.

What about Postcode in Denmark?

This is on a rather long to-do list!

Is the Danish data available openly /freely?

Individual records: No! However, we plan to publish our aggregate data when our study is completed.

Do you look at the combined affluence of the family or of the individual?

A mixture, depending on the marital status of an individual.

Does immigration into Denmark have an impact on the low education mortality?

In general immigration is not that significant in our data. Additionally, quite often immigrants will not have a recorded level of education in the database. We have excluded anyone from our education statistics if they have no recorded education level.

Interesting analysis on Denmark data, but how likely do you think it is that the industry will take on ensuing conclusions based on such small dataset (as Denmark's)?

The Danish dataset is small compared to, say, the UK. But, the Danish dataset is actually not small in the sense that the models themselves are easily able to handle the sampling noise in the subgroup data. The more important point is to what extent the detailed observations about Denmark are relevant to other countries. In some cases the conclusions seem more widely applicable: a wide gap narrowing with age; a widening gap over the last decades. But Denmark has its own idiosyncratic shape linked to lifestyle factors and government policy.

In your study of cause of death (CoD) how do you account for changes in CoD coding (e.g. from ICD9 to ICD10)?

We have deliberately, so far, NOT looked at time trends in CoD rates. This is partly because of changes to the ICD codes but there are also clear differences in how CoD is reported between different countries that we believe are down to local guidelines: e.g. dementia as a cause of death is very much lower in Denmark than in the UK. Instead we have concentrated so far on identifying inequalities by CoD for a given age and year. This does not make any use of time trends or ICD changes. Within the data there might be a jump in CoD death rates that is due to ICD changes, but we assume that the impact of the ICD change would be the same for all socio-economics groups.

Do you anticipate any big data sets becoming newly available to us in the UK?

At least as far as we are aware, there are no easily available big datasets, at least at relatively low cost. But we will be exploring this further.

To what extent can we rely on past mortality improvements to predict future mortality improvements? (When causes of death are changing e.g. Alzheimer's)

No one approach can be considered to be perfect (i.e. extrapolative versus causal models). Recent decades have equally seen different advances, but leading researchers such as James Vaupel have demonstrated that extrapolative models have a very good track record (e.g. Vaupel's timeline showing life expectancy for the "best in class") compared to other more subjective approaches.

How will predictive analytics (big data analysis) affect mortality modelling?

I'm not an expert in this direction, but I feel that it will have a key role to play in the pricing of new business. What might be hard to achieve is introducing a stochastic time element into the impact of individual factors and the relationships between different factors.

Most of the mortality improvement work was about pensioners. Do you think we should also give more focus to assured lives?

We have done some work using CMI assured lives data in the past (e.g. Cairns et al., 2011, ASTIN Bulletin). There are some challenges here (not unique to assured lives): namely that the underlying mix of lives might change over time and there might be a step change in mortality rates around age 65 as some policies mature around that age. Also for assured lives business, the types of stochastic model that might be used could differ from the standard longevity models: specifically, it might be more important to introduce single year shocks around an already stochastic long term trend.

Can some of these ideas be applied to female mortality as well?

All of them can, and are being applied to females' data. Sometimes female data can be a bit more challenging: e.g. the Danish females by affluence level are not as well separated out as the males by affluence group.

Has anyone looked at different countries' rates of improvements separated into whether (or for which periods) they have a broadly socialist government?

Not that I am aware of. Google "life expectancy versus GDP" as above, and check out whether a given list of countries lies above or below the main curve. Let me know if you find anything.

Surprised to see mortality in Denmark is higher than the US given Denmark has free health care and has a reputation of being a happy nation. Any explanations to that?

Free healthcare might help but lifestyle factors also come into play such as smoking, alcohol and diet. And happiness measures don't really differentiate between the rich and the poor: they just look at averages.

The mortality improvement data seemed to imply different causes impacting different age groups. Any research to identify the underlying causes at each age?

There is quite a lot of research going on here, especially in the US where a variety of experts are seeking to explain why US mortality is so poor in the middle ages. So cause of death is very important, which in turn is very heavily influenced by socio-economic factors.

Has Denmark introduced particular policy interventions to lead to these trends in Danish mortality?

We think so, yes, but it is likely to be quite complex and not just a single change in policy at the time when the catch up phase started.

To what extent does immigration impact mortality trend changes in the different countries?

This is difficult to identify, as national mortality data typically don't allow easy identification of migrants.

What do you consider to be the main drivers of difference between countries? What is the ultimate max life expectancy and how quick to reach it?

Lots of factors: lifestyle, diet, healthcare system, social networks,

Personally, I don't believe there is such a thing as a natural maximum life expectancy.

Presumably the data presented today is population data rather than from pensioners/assured lives?

Yes, but we do have some insurance and pensions data that we will be working on.

At the start you showed mortality trends at specimen ages, but shouldn't we be comparing mortality trends for different cohorts?

Yes, we do also look at cohorts and indeed many of the models we consider incorporate cohort effects. In related work before this project we focused on cohorts to improve on the quality of national population data.

Do the data allow for extreme events? Will your research take into consideration potential pandemic and other extreme events?

We don't currently plan to look at pandemic and other extreme events. Given that we have, at best, 50 to 100 year's of data, one can't rely on pure statistics alone to judge the likelihood or severity of such events. There is a space here for objectively developed extreme scenarios.

To what extent is the modelling approach expected to be extrapolative versus "forward looking" (e.g. medical modelling)?

Mainly extrapolative, but also investigating to what extent medical modelling can refine the outputs of these models.

Is any research going to be carried out on mortality improvements of enhanced annuitants?

Only if someone gives us access to large dataset that contains the right type of lives!

Things like affluence and health information could change over time - how do you allow for this in your model?

In the work we have in mind for Denmark, the affluence level for an individual can change up to retirement but is fixed thereafter. This approach mimics the reality of a pension plan or annuity provider: the last contact they might have with a pensioner (other than notification of death) is at the time of retirement, probably with no health information - just income. So they have to work with those limitations when they do valuations.

Have you considered a measure of affluence that takes account of other aspects? For example covering: unemployment, access to health service, living environment?

Not so far.

When you refer to statistically significant differences in all causes of death (CoD) is this in terms of absolute mortality rates, or their contribution to total mortality?

We look at death rates for each CoD in isolation. For a given CoD, each block of ages and block of years, we rank the 10 affluence groups from highest mortality.

Are attempts being made to influence national statistical bodies to capture and share richer datasets?

Many are already working on this, although it might not always be possible to backdate the richness that they might be able to achieve going forward.

Causes of death that were surprisingly associated with affluence: could it also be that poorer housing and nutrition give a poorer environment for recovery?

Thanks, that is a very good suggestion!

Can you distinguish effects of relative affluence and absolute?

This might be possible although not yet done by, e.g., setting group boundaries that escalate in line with CPI rather than decile boundaries.

A death rate is a function of number of deaths and exposed to risk. Is the data consistent in terms of "Exposed to risk groups"?

Yes, deaths are counted out of the exposures in a particular group at the start of a year.

Do you ever see medical error to be a recorded cause of death in the data?

We haven't looked for this.

Many insurance companies use an internal capital model which considers all causes of mortality in aggregate and has a parameterisation consistent with the CMI Mortality Projections Model. Has the research team considered the implications for how such a company should calibrate the risk factor distributions in this type of model?

We will be working on methodologies that will bring together the two disconnected elements that you describe into a single coherent central forecast plus risk assessment.