



Research Project Summary: Development of UK PPO Mortality Tables

Contents

1	Research Project	2
2	Research Project Proposal: Summary	2
3	Details of Current Proposed Research	3
3.1	Background	3
3.2	Purpose and scope of the study.....	4
3.3	Data sources.....	4
3.4	Methodology.....	4
3.4.1	Study design	4
3.4.2	Study population.....	4
3.4.3	Study variables	5
3.4.4	Analysis	5
3.4.5	Confounding variables	6
3.5	Limitations.....	6
3.6	Expected Research Outcomes	6



1 Research Project

'Research into the development of mortality tables for impaired lives (specific to UK Periodical Payment Order awards)'

2 Research Project Proposal: Summary

For some UK non-life insurance companies, periodical payment orders ("PPOs") represent a large and growing percentage of their balance sheet, and have an impact on the pricing and capital modelling efforts of non-life insurance actuaries. The vast majority of these awards arise from motor insurance claims where an affected individual has suffered severe traumatic injury (mainly brain and/or spinal) which results in a permanent disability, requiring long term care and assistance. PPOs represent a very long term annuity-type liability which is different to the normal profile of liabilities of a non-life insurer.

Since October 2018, PPOs have also become a feature of the Irish market.

Under the European Solvency II capital regime for insurers, firms are required to calculate the expected present value of their liabilities on a "best estimate" basis. For PPOs, this requires the firm to make assumptions about the probability that each future PPO instalment will be paid. To do this, firms need to choose an appropriate set of mortality rates for each claimant to calculate the probability of survival to each payment date.

Setting mortality assumptions is relatively straightforward for a typical large book of pension annuities covering individuals whose expected mortality experience will not be too different to the standard population and where there is a large amount of historical mortality data based on actual experience of a very large number of lives over many years. However, for a heterogeneous group of severely disabled lives, it is more challenging to set the appropriate assumptions and questions arise such as:

- How has the mortality experience of lives with a particular type and severity of traumatic injury (whether in receipt of a PPO or not) compared to the general population historically?
- Is there a sufficient quantum of data on the actual mortality experience of severely disabled lives to make reliable estimates of relative mortality rates compared to the general population?
- What allowances should be made for future mortality improvements?
- What adjustments should be made to these mortality rates for the specific situation of an individual life (e.g. based on other criteria such as quality of care or pre-accident state of health)?

The IFoA therefore wishes to commission a feasibility study with the aim of compiling mortality tables of impaired lives who have suffered brain and/or spinal injury following a severe trauma (specific to UK PPO awards). Whilst the research could be hugely beneficial for the non-life insurance



industry, it should be noted that the results of this research could have wider applications. For example, PPOs have been awarded in medical negligence claims against the NHS. The various aspects of this proposal will be refined further with input from stakeholders and partners.

3 Details of Current Proposed Research

3.1 Background

The IFoA PPO Working Party's (WP) aim is to investigate PPOs and their effects on the UK insurance and reinsurance industry, in order to advise non-life actuaries about the impact of PPOs on (re)insurers carrying these liabilities and also on their own work (i.e. the relevance of applying life insurance techniques to the management of these liabilities). One aspect of this is developing an understanding of impaired life mortality as it applies to severely injured individuals. This proposed piece of commissioned research was initiated by the PPO WP mortality work stream group, who has written papers and presented workshops to practitioners and industry detailing its findings. Further information on the PPO WP and its outputs to date can be accessed on [the IFoA's PPO WP webpage](#)¹.

The PPO WP has also undertaken an annual survey of the non-life insurance industry about their experience of PPOs. This has enabled two things. First, the group has been able to create and publish statistics about the number, quantum and nature of PPOs as awarded by the courts. Secondly, the group has asked for qualitative feedback from the industry about their concerns and practices as regards to PPOs. This has formed the basis of guidance issued to practitioners and has informed submissions made in PPO-related consultations.

In 2012, the group investigated Impaired Life Mortality (ILM) specific to UK PPO awards. This is an area identified by the group as worth further exploration as it is one of the main concerns of the industry: how different is ILM from general population mortality? The data/resulting mortality tables could enable more accurate reserving, pricing and capital setting for PPOs.

The group has found several interesting proxies for ILM in UK PPOs (overseas experience, published medical papers) and it has created the beginnings of a mortality table based on the actual PPOs awarded in the UK since 2005 (in practice since 2008 when the rate at which PPOs were awarded increased dramatically to its current level). However, it will be several years, decades even, before the group or the professional body will have the ability to produce a definitive ILM table from actual PPO data. Therefore, the development of mortality tables based on a wider population of impaired lives in the UK, will provide an earlier source of more directly relevant data that will be of value to insurance companies, helping them in their assumption setting for pricing and reserving.

¹ The PPO WP's webpage can be accessed via the IFoA's website as follows; www.actuaries.org.uk > Practice areas > General Insurance > Research working parties > Periodical Payment Orders



3.2 Purpose and scope of the study

The PPO WP wishes to commission a feasibility study through the ARC, which would be refined in partnership with other stakeholders, which aims to establish the feasibility and practical issues to be addressed in:

- compiling a credible set of mortality tables for lives who have suffered the types of traumatic injury that give rise to PPO awards, specific to UK PPO awards, which
- takes into account the distinctive nature of the affected lives compared to those underlying the mortality tables already used for impaired lives in the context of annuity policies, notably the severity of the impairments (the vast majority being people who have suffered severe brain and/or spinal injury) and the age of the people affected, which will be younger than the typical age of impaired annuitants, and
- identifying the most appropriate health database(s) that can be used to compile these tables, e.g. the THIN² and/or CPRD³ GP data sets.

The group hopes that the impaired life data from this population will be sufficiently close to the subset of lives whose impairment derived from motor-related accidents that the mortality experience is a good match. Commissioning this research will determine if this could indeed be the case.

3.3 Data sources

Relevant health databases (e.g. THIN, CPRD or such other sources as identified via the research) with comparison to overall population statistics from the Office of National Statistics (ONS).

Due to the handling of sensitive health data, it is proposed that a third-party body who has the right expertise and protocols is commissioned by the ARC to undertake the research on behalf of the IFoA and its potential partners.

3.4 Methodology

3.4.1 Study design

This aims to be primarily a cohort study as the intention is to assess mortality by age and gender as per typical life tables for those who have a specific category/severity of injury as below.

3.4.2 Study population

The study population will be all impaired lives with a mixture of traumatic brain injury and spinal injuries of differing degrees of severity.

² THIN – The Health Improvement Network

³ CPRD – Clinical Practice Research Datalink



3.4.3 Study variables

This relates to death and injury classification/severity primarily with basic other information required to formulate an assessment of the impaired mortality.

3.4.4 Analysis

The analysis carried out will largely depend on granularity versus credibility. The intention would be to group data into categories - allowing for gender, high-level injury type (as a minimum spinal and brain injury) and severity. Given the sample size, age could also be grouped by age bands, as there is unlikely to be sufficient volume to give credibility to any other splits but this will be an area to be investigated by the commissioned research team.

It is proposed to look at the mortality rate, or probability of death for any given age group, for the next year. This could be estimated by considering:

- Observed number of deaths for the age grouping
- Period of exposure for the individuals within the age grouping

Alongside the development of bespoke mortality table(s) based on the data available, the research could also consider the adjustments that might be made to a standard population mortality table to allow for serious injury and which reflect the results of the analysis set out above.

Different adjustments to standard mortality rates could be made. This would allow standard mortality tables to be adapted for use in calculations where mortality estimates are required for PPO claimants. The appropriateness of each adjustment will depend upon the pattern of additional mortality caused by the serious injury.

There are three commonly used adjustments to standard mortality rates:

Multiplicative adjustment. A constant multiplicative adjustment on its own would be used if the additional mortality rate resulting from the injury was expected to vary by age to the same extent that standard mortality varies by age.

Age adjustment. An age adjustment on its own would be used if the mortality of an individual was expected to be equivalent to the mortality of an average person (with standard population mortality) who is x years older than the individual. This adjustment is commonly used to allow for the effect of chronic conditions such as diabetes.

Additive adjustment. A constant additive adjustment on its own would be used if the impact of the injury on mortality was expected to be independent of age.

The selection of which adjustment is appropriate depends, at a high level, on such factors as:

- Age dependence



- Time since the accident
- “Accident hump” which refers to the phenomenon whereby those in their late teens to mid-twenties have an increased mortality rate due to a higher incidence of accidents in this age group

The impairment due to the injury can cause these factors to behave differently to the standard population mortality tables and the research could investigate whether this is the case – i.e. “Does the injury have more of a standard impact regardless of age?” in which case utilising a method that depends on age may be less appropriate.

It is expected that the base general population data used will be the ONS published mortality tables and population statistics, although this will be subject to discussion with stakeholders and the commissioned research team. In addition, discussion will be needed to consider the extent to which future mortality improvements in the general and impaired populations are allowed for.

3.4.5 Confounding variables

The two greatest confounding variables likely to be relevant in this study are obesity and whether or not the patient is a smoker, and these aspects would need to be considered in the research. The incidences of these items, as long as in line with general population proportions, should not impact the analysis too greatly. Although it should be noted that these may have resulted from the injury of interest due to inactivity etc. Gender is intended to be explicitly allowed for where possible.

3.5 Limitations

The main limitation to the proposed study is likely to be the volume of data, in terms of the number of patients with the relevant impairment(s), rather than the period covered by the data. It is recognised that this exercise in itself is perhaps unlikely to form a sound conclusion but in connection with similar analysis on other pools of data – from the insurance industry and other countries – a view could be formed of how different the life expectancy is for a pool of people with severe spine and brain injury compared with the population on average. It is hoped that over time the emergence of injury specific impaired mortality rates could be understood with a greater degree of granularity and confidence.

It is also recognised there are likely to be limitations within the health database(s) utilised for the study that will be discussed with the commissioned research team.

3.6 Expected Research Outcomes

If successful, the mortality table (or set of tables) will become a reference point for actuaries and others involved in the management of PPO liabilities when considering the future mortality rates likely to be experienced by PPO recipients (e.g. for the purpose of calculating reserves).

It is hoped that the results of this ARC project can be the basis for ongoing further development by the IFoA and [Continuous Mortality Investigation \(CMI\)](#) as part of their work in the future.