

Focus PERSONAL INJURY

Understanding the mathematics of mortality



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The concepts of mortality and life expectancy may be the most misunderstood of the actuarial assumptions used in economic loss valuations. Explained simply, life expectancy is the average future number of years of life remaining for a group of individuals at a particular age. It is a useful concept for visualization and for comparing different mortality tables or assumptions.

Many lawyers are surprised to learn that a plaintiff's "life expectancy" is not actually used in a proper present value calculation. Rather, the courts have long accepted that the correct allowance for the mortality contingency is based on the actuarial present value method. Under this method, the loss in each future year is discounted by the likelihood of survival to that year based on the age-by-age mortality rates of the accepted statistical table. For a lifetime loss, this calculation is applied separately to each future year up to age 100 and beyond, according to the limits of the accepted table. It is this method which accurately determines the amount required to be exactly sufficient on average (no more and no less) to replace the stipu-



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lated loss.

Confused by the difference? Let's look at an example.

Suppose we wish to determine the present value of a future loss for a male aged 45 in the amount of \$1,000 per year for the full remainder of life. According to the recently published Life Tables for Canada, 2009-2011, the remaining life expectancy for a 45-year-old male is 36.17 years or to age 81.17. One possible calculation

approach would be to determine the present value based on a fixed amount of \$1,000 annually for 36.17 years. However, it can be demonstrated mathematically that this calculation will always overvalue the correct amount required. While this overstatement may initially appeal to a plaintiff's lawyer, it won't seem as attractive when the expert's calculation is discredited in court.

Another incorrect calculation approach which we sometimes see in lifetime loss valuations proceeds by discounting each future year's loss by the likelihood of survival to that year, stopping the calculation at the age at which the assumed life expectancy is reached. It's easy to show that this approach will always undervalue the loss

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because it “double counts” the mortality contingency discount.

An additional misconception we occasionally encounter is that the life expectancy at birth is a correct assumption for the expected average age at death, regardless of the individual's current actual age. But clearly, if you have made it to (for example) age 70 by successfully avoiding the risks of an earlier demise, then the likelihood of a shorter lifetime must be dropped out of the average calculation. According to the above table, the remaining life expectancy for a 70-year-old male is 15.13 years, or to age 85.13, which compares to age 79.33 for a male at birth and age 81.17 for our 45-year-old male. The fallacy in this misconception is readily observed by considering the remaining

life expectancy for a reasonably healthy 90-year-old female. Already dead? Not! Her remaining life expectancy is 5.35 years according to the above table.

So, while life expectancy is convenient for visualization and comparison purposes, it cannot be used directly for present value calculations. You should ensure that your expert valuator is using the correct actuarial present value calculation method.

What about reduced life expectancy calculations?

The first point to note is that while actuaries have some training in the medical underwriting field, they are not doctors and they do not have readily available mortality tables for any given medical condition. Furthermore, most attending physicians are not experienced in medical underwriting and are (properly) reluctant to opine on the remaining life expectancy of their patient.

The court-accepted proper process for establishing a reduced life expectancy (or more properly, an increased mortality risk) is to obtain an expert opinion from a qualified medical professional with experience in medical underwriting. Most commonly, this opinion will be expressed in terms of an adjustment which should be applied to the age-by-age mortality rates from the relevant table, e.g. 400 per cent (sometimes expressed as +300 per cent), or four times the standard age-by-age mortality rates of the table. This assumption will be used by your actuary to determine the loss using the actuarial present value method, and your actuary can also quote the adjusted remaining life expectancy to assist you in visualizing the effect of the medical opinion. But remember, the adjusted life expectancy cannot be used directly to perform the calculations.

In summary, the personal injury lawyer needn't be an expert in the mathematics of mortality (a field known as life contingencies). However, you'll want to ensure that your economic loss valuator is an expert in this facet of valuation — particularly if the plaintiff is not in good health.

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