

Modelling the impacts of climate change on deaths caused by heat and cold waves with age–period–cohort models

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Actuaries increasingly assess physical risks from climate change, including its impact on mortality in life insurance products, annuities, and pension plans. While actuarial methods project mortality decades ahead, they seldom account for climate change. We propose an age–period–cohort framework to capture mortality dynamics from heat and cold waves. The model allows us to capture the high-frequency nature of daily death counts. A seasonal overlay, based on a cyclic spline, and a transformation of temperature variables—which rely on a parsimonious version of a distributed lag non-linear model—enhances projections. Using mortality data from Retraite Québec and climate model ensembles, we estimate mortality rates by age and sex and for various emissions scenarios. This presentation further explores future mortality patterns in Quebec and their implications for life insurers and pension plans.

This is joint work with Mathieu Boudreault and Thomas Landry.

Keywords: Mortality; Climate change; Physical risk; Heat and cold waves; Age–period–cohort framework.

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