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# Joint probabilistic projection of female and male life expectancy

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## Abstract

**Background:** The United Nations (UN) produces population projections for all countries every two years. These are used by international organizations, governments, the private sector and researchers for policy planning, for monitoring development goals, as inputs to economic and environmental models, and for social and health research. The UN is considering producing fully probabilistic population projections, for which joint probabilistic projections of future female and male life expectancy at birth are needed.

**Objective:** We propose a methodology for obtaining joint probabilistic projections of female and male life expectancy at birth.

**Methods:** We first project female life expectancy using a one-sex method for probabilistic projection of life expectancy. We then project the gap between female and male life expectancy. We propose an autoregressive model for the gap in a future time period for a particular country, which is a function of female life expectancy and a t-distributed random perturbation. This method takes into account mortality data limitations, is comparable across countries, and accounts for shocks. We estimate all parameters based on life expectancy estimates for 1950-2010. The methods are implemented in the `bayesLife` and `bayesPop` R packages.

**Results:** We evaluated our model using out-of-sample projections for the period 1995-2010 and found that our method performed better than several possible alternatives.

**Conclusions:** We find that the average gap between female and male life expectancy has been increasing for female life expectancy below 75, and decreasing for female life expectancy above 75. Our projections of the gap are lower than the UN' s 2008 projections for most countries and thus lead to higher projections of male life expectancy.

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