Time trends in the male accident hump: A biological clock for men?

Extended Abstract for Proposed PAA (2005) Presentation

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September 23, 2004

The proposed paper looks at time-trends and cross-cultural comparisons in the timing and magnitude of the male accident hump, the surplus mortality that is observed in young adult males. This accident hump coincides with the peak of testosterone over the life cycle and is presumably driven at least part by the male biological life cycle. It may have evolved as a by-product of risk-taking behavior that among our distant ancestors increased mating opportunities.

Early results detect an accident hump in mortality curves from as early as the mid-18th century. A shift of the curve to younger ages seems to have occurred over time, either as a result of changing risk conditions (e.g., the introduction of the automobile) or changing risk-taking behavior, perhaps brought about by accelerated hormonal timing by males exposed to secular improvements in nutrition.

The persistence of the accident hump and changes in its timing are of interest for several reasons. First, for mortality forecasters, the increasing peakedness of the accident hump in extrapolatory models such as Lee and Carter is taken as an unrealistic feature of these models. By focusing on the accident hump alone, we can get a sense of the realism of future forecasts. Second, because of its potential as a behavioral proxy of underlying endocrinal function, the study of the surplus mortality gives insights into changes in human biology and development over time. Finally, if we accept the proposition that the accident hump is an indicator of the male biological clock, the timing of the accident hump in relation to the social life cycle of human males is of particular interest. At the same time that the accident hump is fixed or getting younger, many other life cycle events are being delayed. This separation between the onset and completion of adulthood means that many of life cycle transitions are now taking place well after the risk-taking peak seen in the accident hump. This has implications for spousal choice, childrearing, and career trajectories.

Data and Methods

We use publicly available life tables from the Human Mortality Database (www.mortality.org). These date back for some countries into the mid-18th century. Geographic coverage is increasing; the current comparisons envisioned are between Sweden, the United States, and Japan.

A simple way to measure the accident hump is to define it as departures from the Gompertz curve of exponentially increasing mortality with age. We fit the Gompertz curve from ages 15 through 80 and measure departures from this curve as "surplus" or "deficit" mortality. The timing of the accident hump is then the maximum of this surplus mortality, under age 40. This approach can be modified in several ways: first, one can fit only older ages, say over 40, and then extrapolate. However, the approach taken here will tend to be conservative, because the Gompertz fit that includes the younger ages will have smaller residuals at these ages.

Another approach is to look at the ratio of male to female mortality. Before the mortality transition, maternal mortality was high and so there was excess mortality among women as well as men. However, in modern times, there is little childbearing-related mortality for women at younger ages. An advantage of using Male/Female comparisons is that it allows the baseline to be non-Gompertzian. Also, since we are interested in the effects of testosterone and male developmental timing, females provide the natural low-testosterone comparison group.

We plan to investigate more complex multiparameter models to obtain other perspectives on the accident hump.

Preliminary results

In Sweden, using the simple Gompertz model to measure excess male mortality, we see a clear shift in the timing of the accident hump over the past three centuries. In the 18th century, surplus male mortality peaked at age 23. Today, the peak is closer to age 18. (See figure, panel a).

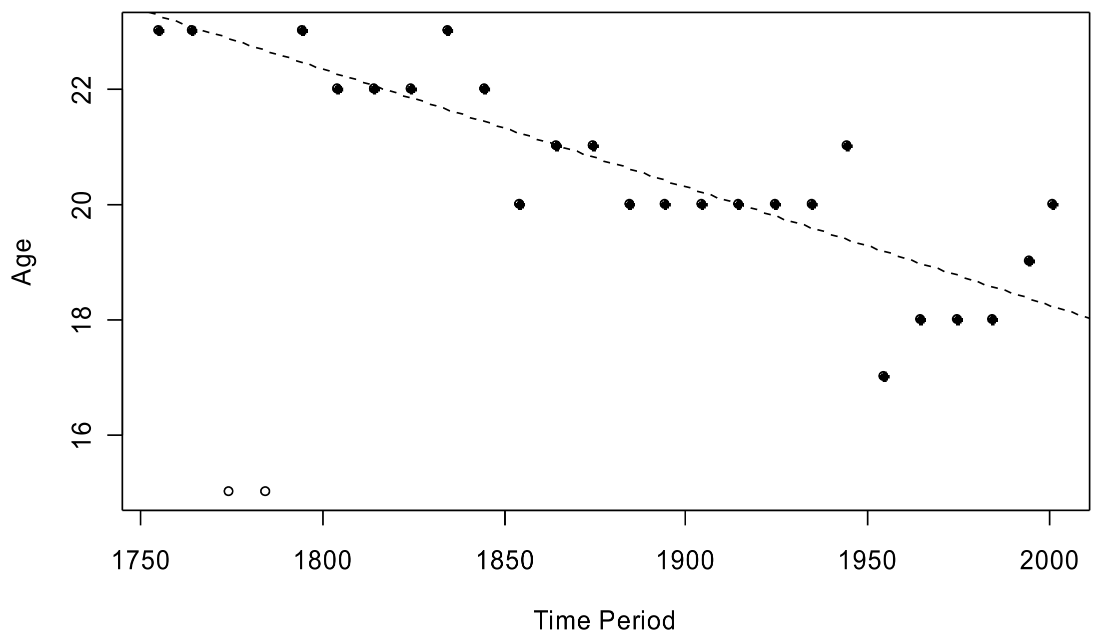
Furthermore, looking in detail at departures from the Gompertz curve, we can see that the entire profile of the accident hump has shifted to younger ages, not just the peak (Figure, panel b).

Finally, we see that the magnitude of the hump, has increased. The hump measures proportional departures, so part of the reason for this is that background mortality has fallen.

These results need to be checked. To guard against the possibility that our measurement is an artifact of the changing appropriateness of the Gompertz curve at younger ages one can compare the ratios of male to female mortality. It is conceivable that the decline in background disease-related mortality could be changing the Gompertz curve in such a way that even a constant timing of surplus mortality would be seen as shifting to younger ages. These technical issues need to be investigated further.

Still, taking the results at face value would suggest a long-term secular decline in the onset and peak of the accident hump. Notably, it appears this decline began before the introduction of automobiles.

(a) Age at which surplus Swedish male mortality peaks using method of Gompertz residuals



(b) Selected surplus mortality profiles for Swedish males, 1755-1995