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Title Page

Type: Letter to the Editor

Title: Visualising the historical and contemporary differences in mortality between the US and Canada using Lexis diagrams.

Shorten title: Visualising mortality differences.

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To better appreciate mortality differences between two countries, it is useful to compare sex specific rates across both age-groups and time. Lexis diagrams facilitate this [1], but have remained under-utilised. Combining two Lexis diagrams allows us to effectively visualise changes in comparative mortality ratios between two countries both over time, between years and within cohorts. To highlight this, the example of comparing the ratio of mortality rates in the US and Canada is presented.

Mortality data was gathered from the 'Human Mortality Database' [2], which provides both birth and death counts for 37 countries. Mortality rates were collected for individual (1933-2007) years and ages (0-100). This was input into the software 'Lexis', to produce the figures shown here illustrating the variation in mortality ratios between the two countries [3]. Both the data and software are freely available for any researcher to be able to replicate this study.

Figures 1 and 2 show the ratio of US and Canadian mortality rates, split by sex. Canada has consistently had lower rates of mortality for those aged 20 to 60 over the time period shown. This difference appears to have strengthened since the 1980s, around the time of the introduction of the Canadian Health Act, which prohibited the use of fees and extra billing by doctors [4]. Whilst Canada has generally benefited from suffering lower mortality below the age of 60 than the USA, until the 1980s mortality rates were higher for those in Canada under the age of under 20, as compared to the same age groups in the USA. The gradual reversal in this pattern started from around the period of the introduction of the current health care system, leading to a widening gap which has been recognised in infants since 1996, but not for the wider age group or time period [5].

In the US, mortality has generally been lower than in Canada at older ages, although this advantage has also reduced in recent years. We do not plot values above the age 100 due to

the low numbers involved, but especially due to there being few Canadian's reported as living past 100, unlike in the more populous USA. Whilst Canada has traditionally enjoyed lower mortality rates than the USA, it does not experience much extreme longevity. Inequality in mortality in the USA, with more people dying young and more living to be very old, continues to be far higher than in Canada. However, since the mid-nineties (especially with females), the relative advantages for older citizens of the USA have been diminishing and the disadvantages for younger adults have been growing.

There have been many studies that have tried to understand why mortality rates vary as they do between Canada and the US. These often concentrate on particular medical interventions [6]. Few take a more historical and societal overview. Lexis diagrams effectively visualise these changing patterns and trends efficiently, improving our understanding of the processes that have led to these inequalities.

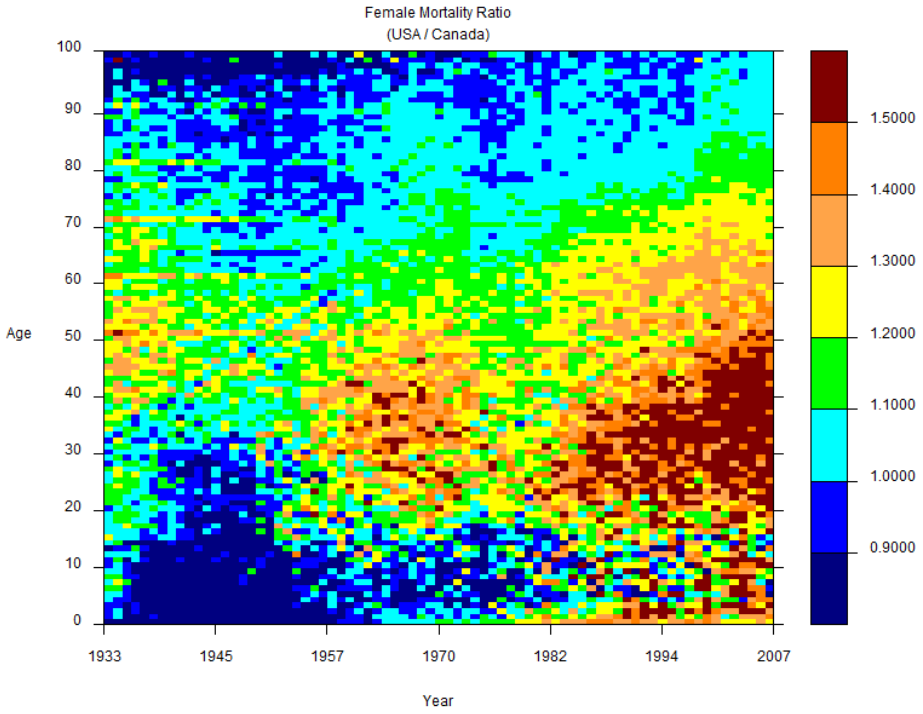

Figure 1. A Lexis diagram comparing female mortality patterns between USA and Canada.

Key: The diagram presents a ratio of mortality rates (the mortality rate of the USA divided by the Canadian mortality rate), with each pixel representing a specific single year and single year-of-age-group. A value greater than one indicates that the female mortality rate in America is higher than in Canada for that specific age and time period, and vice versa. For example a value of 1.4 reveals that in America, the mortality rate is 40 per cent higher than for the equivalent year and age group of people living then in Canada.

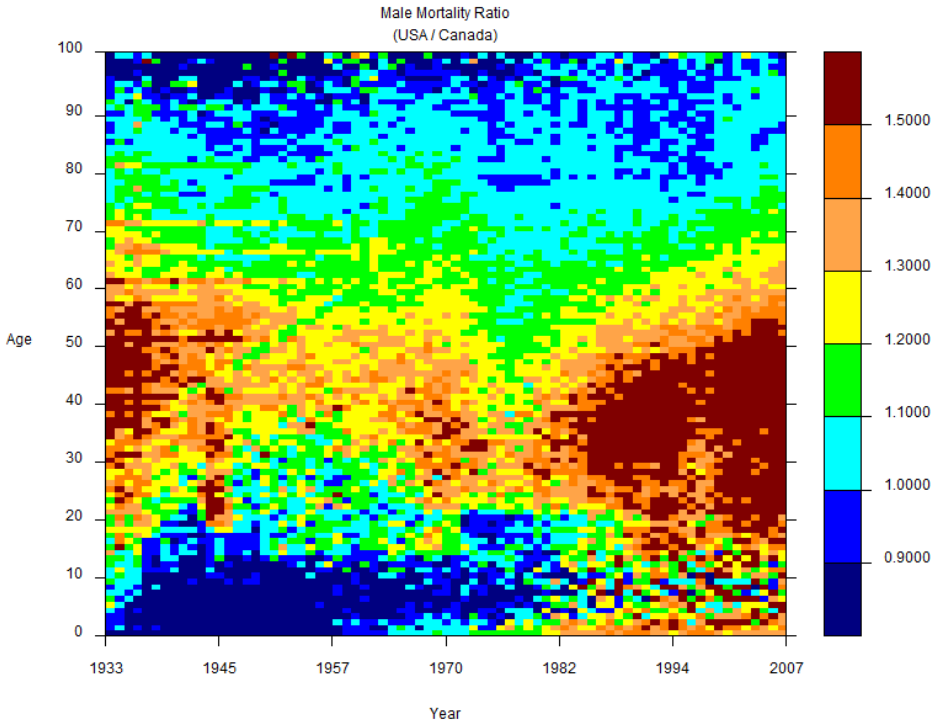

Figure 2. A Lexis diagram comparing male mortality patterns between USA and Canada (see key to Figure 1 for details on interpretation).

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Conflicts of interest: None.

REFERENCES

[1] Lexis W. *Einleitung in die Theorie der Bevölkerungsstatistik*. Strassburg: Karl J. Trübner; 1875.

[2] *Human Mortality Database*. University of California, Berkeley (USA), and Max Planck Institute for Demographic Research (Germany). Available at www.mortality.org or www.humanmortality.de (data downloaded on 21th May 2012).

[3] Andreev KF. Evolution of the Danish Population from 1835 to 2000. http://www.demogr.mpg.de/books/odense/9/cd/default.htm. Accessed May 25, 2012.

[4] Iglehart JK. Revisiting the Canadian Health Care System. *N Engl J Med*. 2000; 342(26): 2007-2012.

[5] Ananth CV, Liu S, Joseph KS, Kramer MS, for the Fetal and Infant Health Study Group of the Canadian Perinatal Surveillance System. A comparison of foetal and infant mortality in the United States and Canada. *Int J Epidemiol*. 2009;38(2):480-489.

[6] Guyatt GH, Devereaux PJ, Lexchin J, et al. A systematic review of studies comparing health outcomes in Canada and the United States. *Open Med*. 2007;1(1):27-36.