

# **Causes of Lagging Life Expectancy at Older Ages in the United States**

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The United States falls well behind world leaders in life expectancy at birth. Some of the discrepancy is attributable to relatively high infant mortality and some to high mortality from violence among young adults. But the bulk of the discrepancy is attributable to mortality above age 50, an age to which 94% of newborns in the United States will survive according to the 2006 US life table. Life expectancy at age 50 in the United States ranks 29<sup>th</sup> highest in the world in 2006 according to the World Health Organization (WHO 2009). It falls 3.3 years behind the leader, Japan, and more than 1.5 years behind Australia, Canada, France, Italy, Iceland, Spain, and Switzerland. At the conventional value of \$100,000 per additional year of life (Cutler 2004), the relative loss of life in the US above age 50 is valued at roughly \$600 billion annually. Using Japan as a standard, the loss is \$1.3 trillion.

This project investigates two explanations of the poor ranking of the US in longevity at older ages. One explanation is a poor performance by the US health care system – the array of hospitals, doctors and other health care professionals, the techniques they employ, and the institutions that govern access to and utilization of them. We find little evidence that the US health care system is performing poorly in terms of its effect on longevity. The second explanation is the history of exceptionally heavy cigarette smoking in the US. We find considerable evidence that this factor is playing a major role in the poor ranking of life expectancy in the US.

### The Health Care System

In Preston and Ho (2009), we present a variety of evidence on the relative performance of the US health care system, using death avoidance as the sole criterion. We find that, by standards of OECD countries, the US does well in terms of screening for cancer, survival rates from cancer, survival rates after heart attacks and strokes, and medication of individuals with high levels of blood pressure or cholesterol. Thanks to cancer registries in many countries, cancer survival rates are among the most reliable and comparable international data. Table 1 presents five-year survival rates for the major cancers in the US registries and in a composite of European registries. Survival rates are higher in the US at all sites. Among the 21 countries (not including Iceland, whose rates are based on few observations), US survival rates ranked first in prostate cancer, breast cancer, and colorectal cancer, and second in lung cancer.

To investigate whether the US is simply identifying cancers sooner without affecting their clinical course, we consider in greater depth mortality from prostate cancer and breast cancer. Prostate cancer has a relatively flat landscape of behavioral risk factors, making it a purer test of medical system effectiveness than many other diseases. Breast cancer has several behavioral correlates including obesity, for which adverse trends in the US would reduce the rate of mortality decline. Preston and Ho (2009) show that

- effective methods of screening for these diseases have been developed relatively recently;
- these diagnostic methods have been deployed earlier and more widely in the US than in most comparison countries;
- effective methods are being used to treat these diseases; and
- the US has had a significantly faster decline in mortality from these diseases than comparison countries.

Figure 1 presents the time series of prostate cancer mortality in the US and in a composite of 16 OECD countries.

#### Cigarette smoking

The United States had the highest level of cigarette consumption per capita in the developed world over a 50-year period ending in the mid-1980's (Forey et al. 2002). Smoking in early life has left an imprint on mortality patterns that remains visible as heavy-smoking cohorts age (Preston and Wang 2006). In Preston, Gleib, and Wilmoth (2009), we develop a new method to study whether and how this history has affected comparative mortality levels.

Using the death rate from lung cancer as an indicator of the damage from smoking, the method establishes a statistical relationship between mortality from lung cancer and mortality from all other causes of death combined. To estimate parameters of the statistical model, we used annual data by sex and five-year age groups (50-54,...80-84,85+) for 20 high-income countries since 1950. Death counts by cause of death are drawn from the WHO Mortality Database (World Health Organization 2008). All-cause death counts, exposure estimates, and death rates come from the Human Mortality Database (2008). The data set contained 280.6 million deaths and 9.765 billion person-

years of exposure. Period effects, country fixed effects, and period/country interactions are controlled in the analysis.

Results of the method are compared to those of a method that assumes that the relative risk of death from smoking for various causes of death is constant across populations. The two methods produce very similar results for both males and females with respect to both the estimated proportion of deaths attributable to smoking and its international distribution. The correlation between the attributable risk fractions for the two methods is 0.96 for males and 0.94 for females.

We find that male mortality has been much more heavily influenced by smoking than female mortality, but that the attributable risk fraction for women has been rising more rapidly. In 2003, the highest percentage of male deaths that was attributable to smoking occurred in Hungary (32 percent); among women, the highest fraction occurred in the United States (24 percent).

Life expectancy at age 50 ( $e_{50}$ ) has been powerfully influenced by smoking in many countries. In the United States, we estimate that male  $e_{50}$  in 2003 would be 2.8 years higher if smoking-attributable deaths were eliminated, while female  $e_{50}$  would grow by 2.6 years. Removing smoking-attributable deaths for all countries would improve the  $e_{50}$  ranking of US women from 17<sup>th</sup> (out of 20) to 7<sup>th</sup>; men's ranking would improve from 14<sup>th</sup> to 9<sup>th</sup>. Thus, we estimate that life expectancy at age 50 in the US would move from well below the median for OECD countries to above the median if deaths attributable to smoking were removed for all countries.

Smoking has also influenced mortality trends. We estimate that the increased damage from smoking among US women reduced their gains in  $e_{50}$  since 1980 by 1.2 years. The total gain in  $e_{50}$  since 1980 was only 1.7 years for US women compared with an average of 3.2 years for the other 19 countries. Figure 2 demonstrates the actual evolution of  $e_{50}$  in the United States since 1950 and presents our estimates of what the trend would have looked like without smoking-attributable deaths. The discrepancy between the two series for males widened steadily from 0.7 years in 1950 to 3.3 years in 1990, but has since begun a slow contraction to 2.8 years in 2005. In contrast, the discrepancy between the two series for women began to widen rapidly after 1975 and has continued to grow, reaching 2.7 years by 2005.

The earlier impact of smoking on male mortality and the catch-up phase for women has produced a striking pattern of sex mortality differentials. Figure 3 shows the actual trend in the difference between female and male life expectancy at age 50. The hill-shaped pattern begins at a difference just under 4 years, rises to a peak of nearly 6 years, and then declines to just below its starting value by 2005. This hill appears to be entirely attributable to smoking; the figure shows that, without smoking deaths, the sex difference in  $e_{50}$  would have held steadily within the range of 3-4 years.

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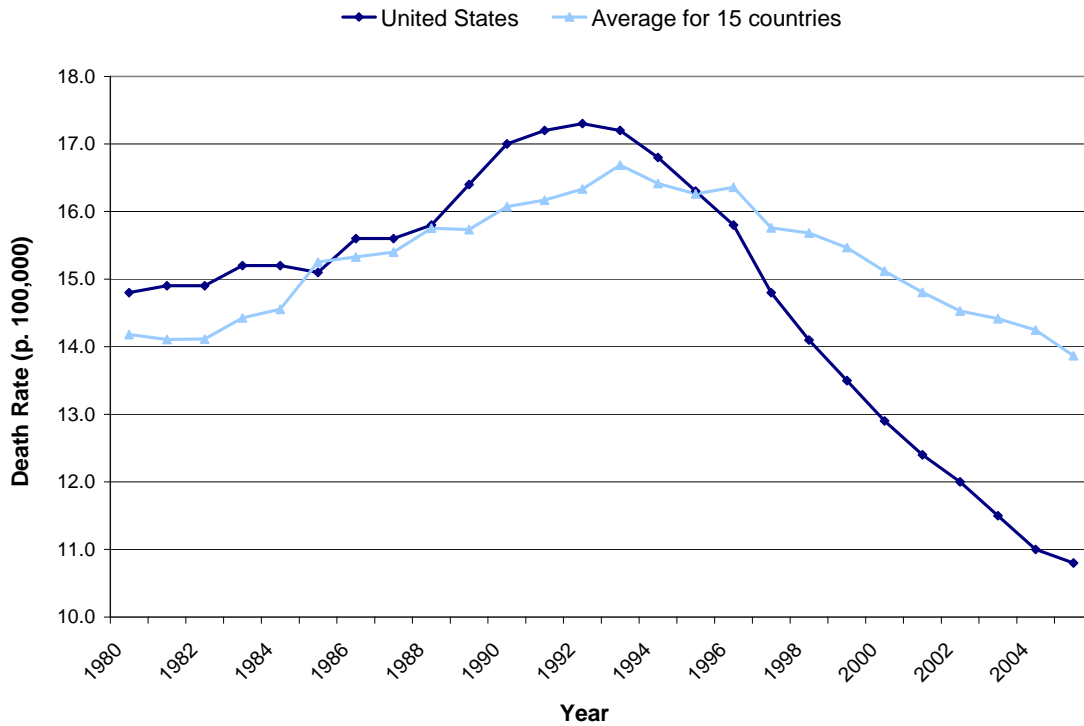
Table 1. Five-Year Relative Survival Rates for Cancer of Different Sites, US and European Cancer Registries.\*

Site	5-year survival rate (%)	
	United States	Europe
Prostate	99.3	77.5
Skin melanoma	92.3	86.1
Breast	90.1	79.0
Corpus uteri	82.3	78.0
Colorectum	65.5	56.2
Non-Hodgkin lymphoma	62.0	54.6
Stomach	25.0	24.9
Lung	15.7	10.9
All malignancies (men)	66.3	47.3
All malignancies (women)	62.9	55.8

\*Based on period survival data for 2000-02

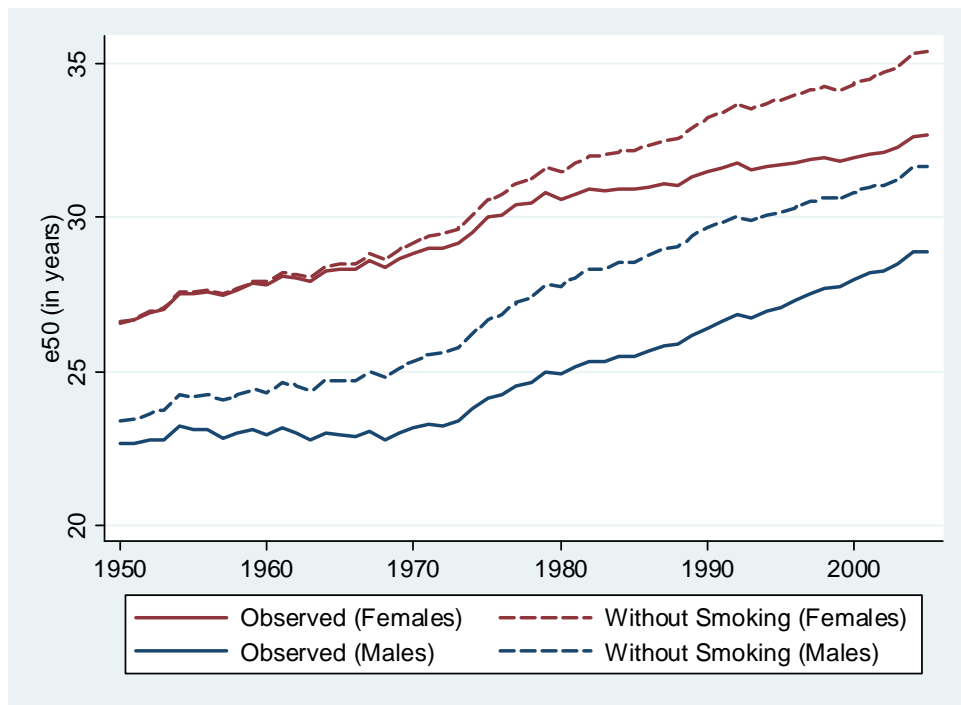
Source: Verdecchia et al. (2007).

Figure 1. Age-Standardized Death Rates From Prostate Cancer, 1980-2005.



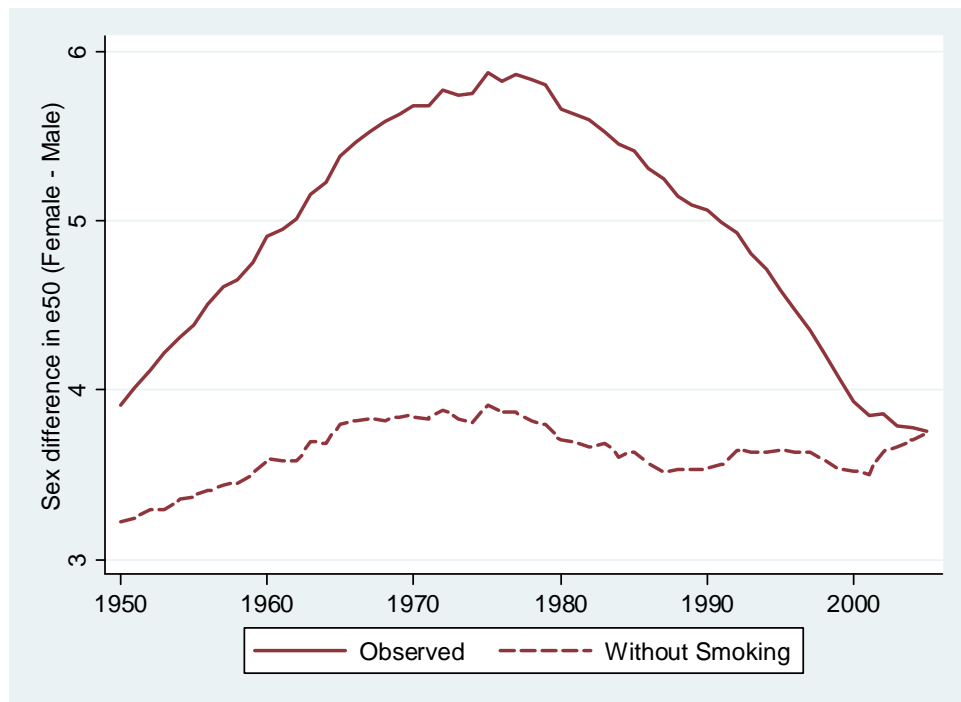
Source: Preston and Ho (2009).

Figure 2. U.S. Trends in Observed  $e_{50}$  and Estimated  $e_{50}$  Without Smoking by Sex.



Source: Preston, Glei, and Wilmoth (2009).

Figure 3. U.S. Trends in the Observed Sex Difference in  $e_{50}$  and the Estimated Sex Difference Without Smoking.



Source: Preston, Glei, and Wilmoth (2009).