

The Significance of Education for Mortality Compression in the United States

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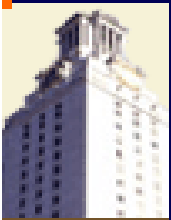


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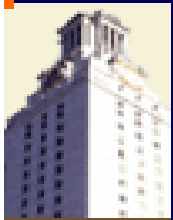
Background

- Growing interest in whether mortality has become increasingly compressed
- Is there a biologically determined upper-limit to the human lifespan?
- Assumption: Temporal and national variability in mortality compression is due to socioeconomic development.
- If we extend this logic, then socioeconomic differentials in mortality compression should exist within a single nation in a given period.



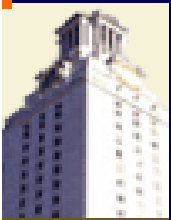
Research Questions

- Are there educational differentials in mortality compression?
- Given women's lower mortality and smaller educational gradient, how do men and women differ in mortality compression?
- We hypothesize that mortality will be more compressed as education increases.
- We also hypothesize that highly educated women experience the greatest degree of mortality compression of all sex-education groups.



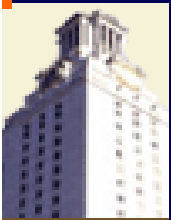
Data

- The Health and Retirement Study (HRS)
 - Nationally representative sample of the U.S. civilian, non-institutionalized population ages 51 and above and their spouses
 - Longitudinal survey began in 1992
- Sample restrictions in our analyses:
 - Survey years: 1992-2004
 - Native born respondents ages 50+ without missing education data



Measures

- Dependent variable: whether death occurred (from any cause) during a calendar year
- Independent variables:
 - Exact age on January 1st
 - Sex (1 = Male, 0 = Female)
 - Education in years: 0-11 years, 12 years, and 13 years or more



Methods: Life Tables

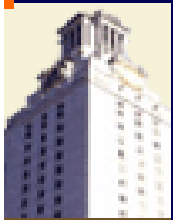
- Sex-education specific life tables derived from statistical models of the risk of death
- Sex-specific mortality models were estimated that included exact age and education group
- Gompertz models were assumed for both men and women, and education was allowed to interact with age

$$\ln m_m(x) = \beta_{m0} + \beta_{m1} \text{Age}_x + \beta_{m2} \text{Ed}<12 + \beta_{m3} \text{Ed}12 + \beta_{m4} \text{Age} * \text{Ed}<12 + \beta_{m5} \text{Age} * \text{Ed}12$$

$$\ln m_f(x) = \beta_{f0} + \beta_{f1} \text{AGE}_x + \beta_{f2} \text{Ed}<12 + \beta_{f3} \text{Ed}12 + \beta_{f4} \text{Age} * \text{Ed}<12 + \beta_{f5} \text{Age} * \text{Ed}12$$

where,

$$m(x) = \lim_{\Delta \rightarrow 0} \frac{P(x, x + \Delta)}{\Delta}$$

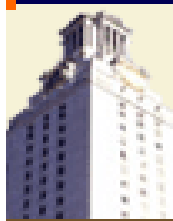


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Methods: Rectangularization

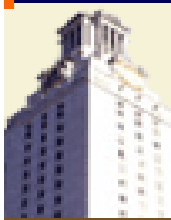
- We follow the approach recently introduced by Cheung, et al. (2005)
 - Modal age of death: The age corresponding to the largest value in the $l(x)$ series of the life table (M)
 - Mortality compression: The standard deviation above the modal age of death ($SD(M+)$) and ages of death within plus or minus 3 standard deviations of the modal age of death ($M \pm 3SD(M+)$)
 - “Verticalization”: The verticality of the right-hand tail of the survival curve. This is a right angle with a range of 0° to 90° (i.e., smaller values = more vertical, larger values = less vertical).



Results

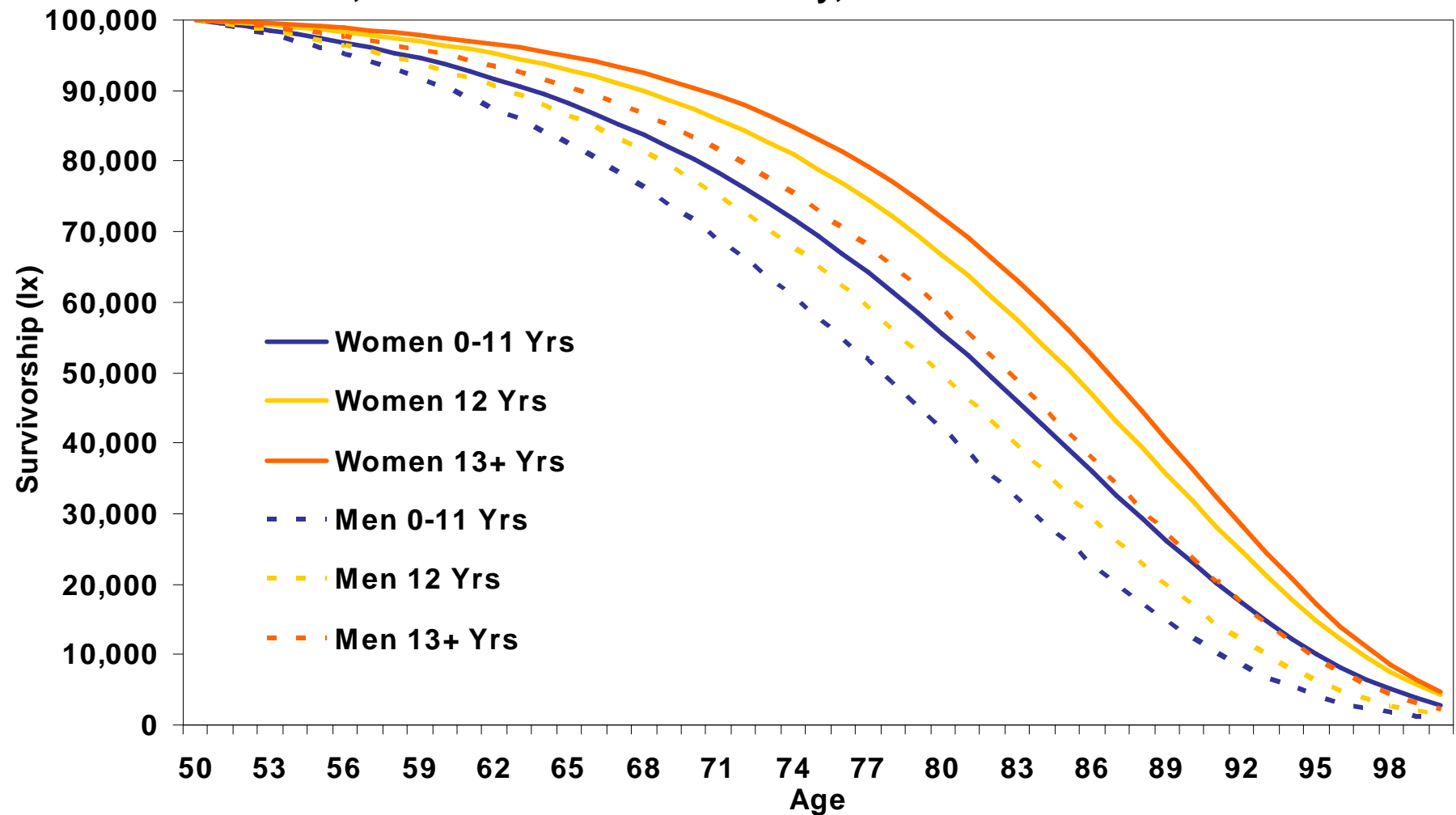
Table 1. Number of Deaths by Sex and Education, HRS, 1992-2004

	<u>Total</u>		<u>Ages 90+</u>	
	Men	Women	Men	Women
0-11 Years	1,413	1,624	189	340
12 Years	854	999	50	118
13+ Years	849	479	67	148



Results

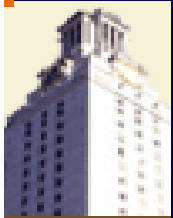
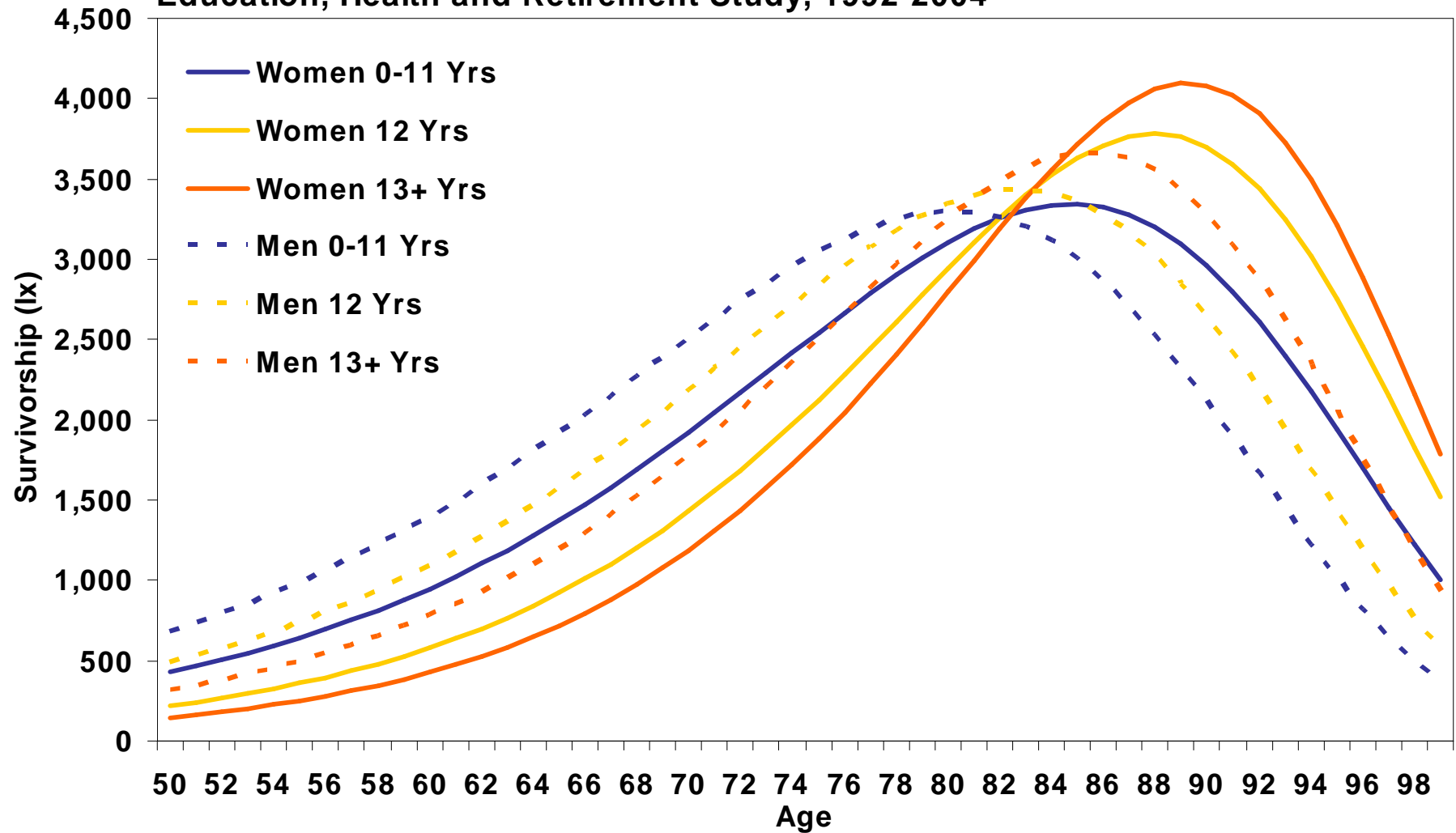
Figure 1. Survival Curves (lx) for Men and Women Ages 50+ by Education, Health and Retirement Study, 1992-2004



$$m(x) = \lim_{\Delta x \rightarrow 0} \frac{P(x+x+n)}{n}$$

Results

Figure 2. Number of deaths (dx) for Men and Women Ages 50+ by Education, Health and Retirement Study, 1992-2004



Results

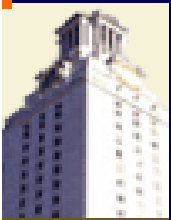
Table 2. Dispersion Around the Modal Age at Death & the Degree of Verticalization by Sex & Education, HRS, 1992-2004

	Education		
	0-11 Yrs	12 Yrs	13+ Yrs
<u>Men</u>			
Modal age at death	80.65	83.21	85.99
Standard Deviation	8.10	7.48	6.26
Verticalization	23.74	22.39	20.53
<u>Women</u>			
Modal age at death	85.20	88.46	89.77
Standard Deviation	7.07	5.59	4.87
Verticalization	22.33	19.41	17.58



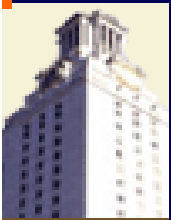
Conclusion

- Educated groups have higher modal ages of death than less educated groups.
- Mortality is more compressed among groups with higher levels of education (e.g., smaller standard deviations).
- The right hand tails of the survival curves are more vertical among groups with higher levels of education (e.g., smaller values).
- Women live considerably longer and display more mortality compression than men at all levels of education
- The group with the greatest compression of mortality is highly educated women



Conclusion

- Educated populations have greater access to resources which allow them to optimize their health.
- Women are more advantaged than men, especially at higher levels of education.
- Mortality among the socioeconomically advantaged provides a glimpse into the mortality dynamics of the population as a whole in the future.
- We have replicated these results with the National Health Interview Survey Linked Mortality Files (NHIS-LMF).
- Our next step is to use the SPACE program to obtain confidence intervals for the rectangularization measures.



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