Selection in infant mortality

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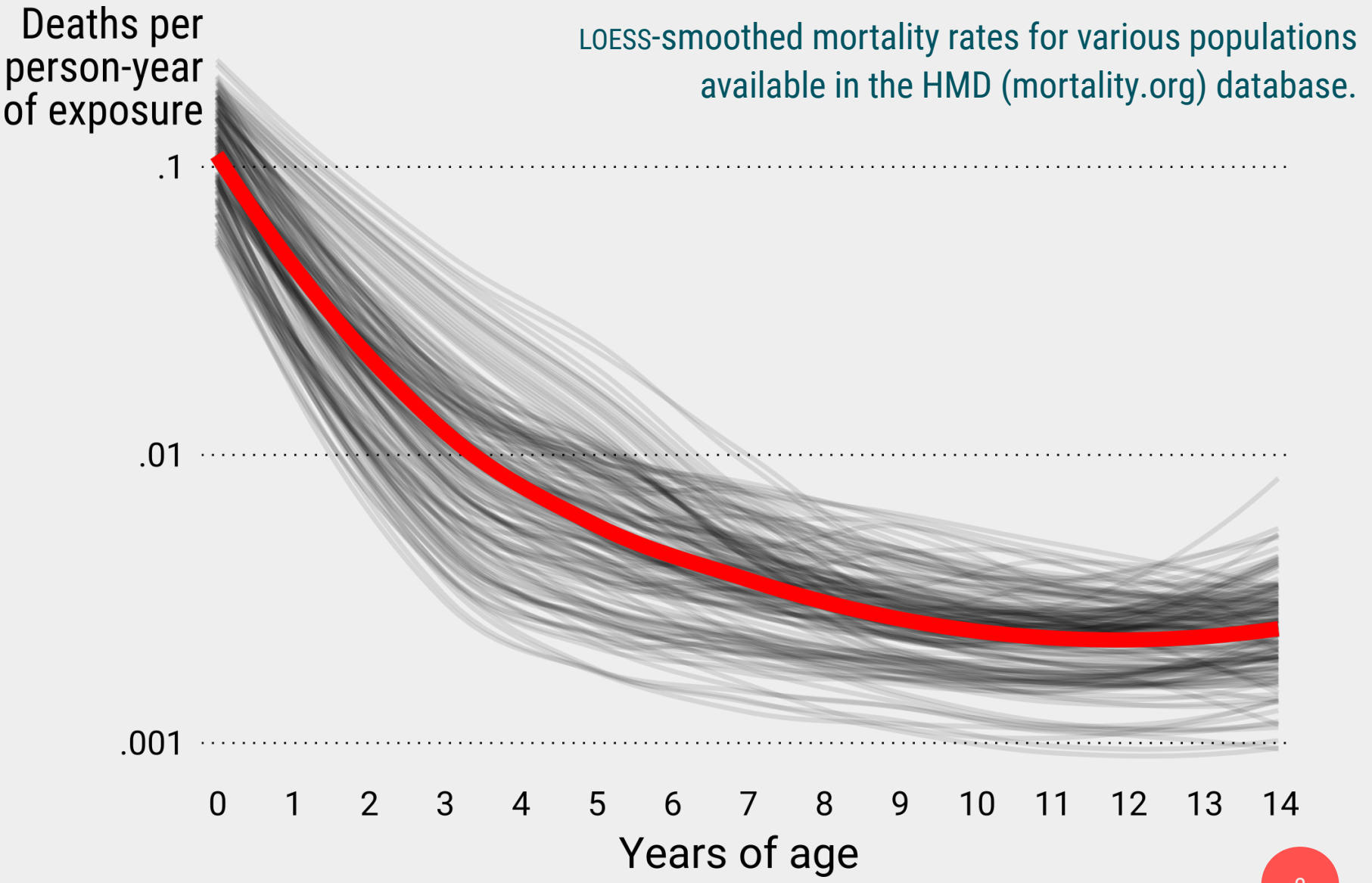
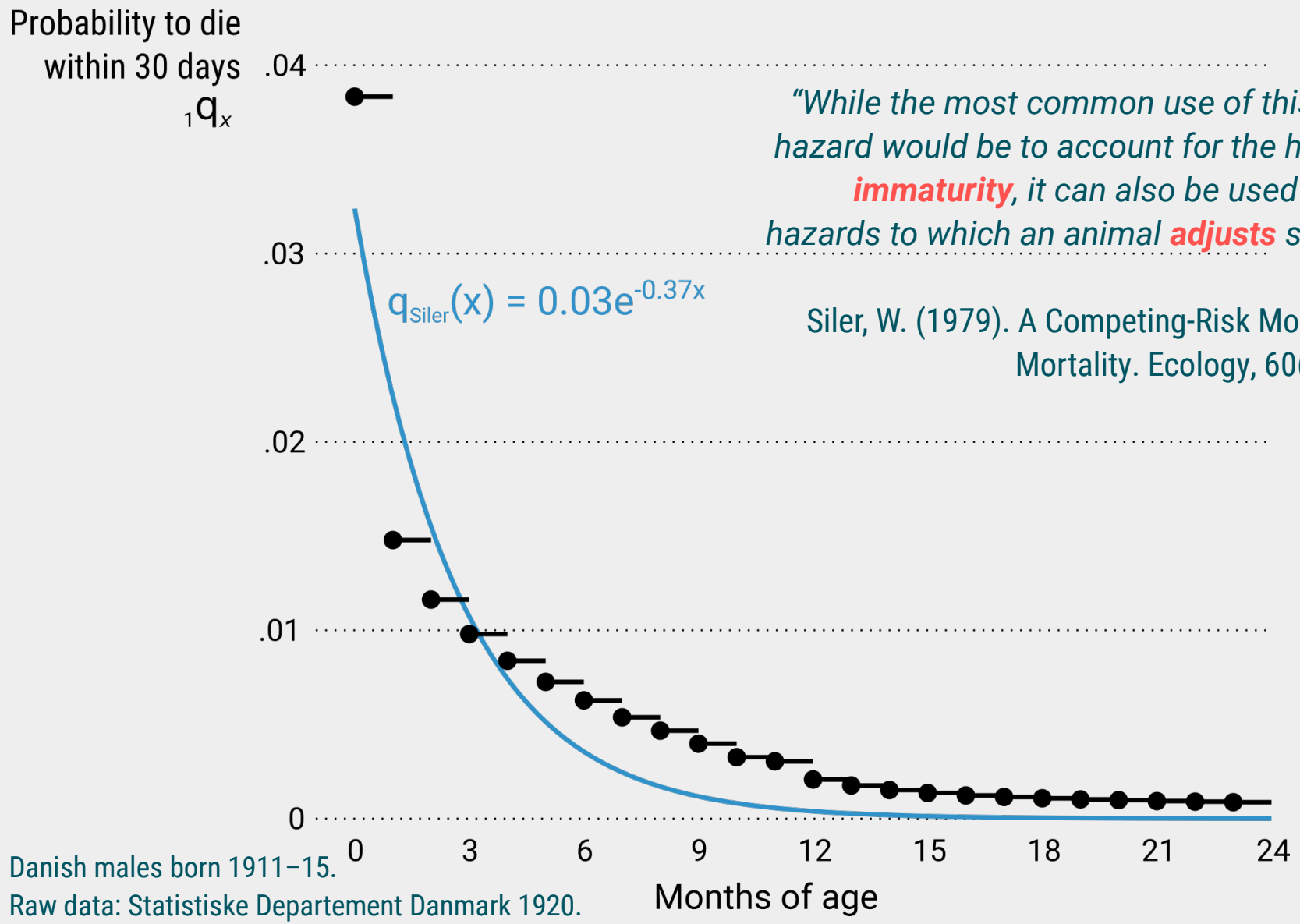
The age pattern of early life mortality



LOESS-smoothed mortality rates for various populations available in the HMD (mortality.org) database.

Mortality decline as growth and adaptation

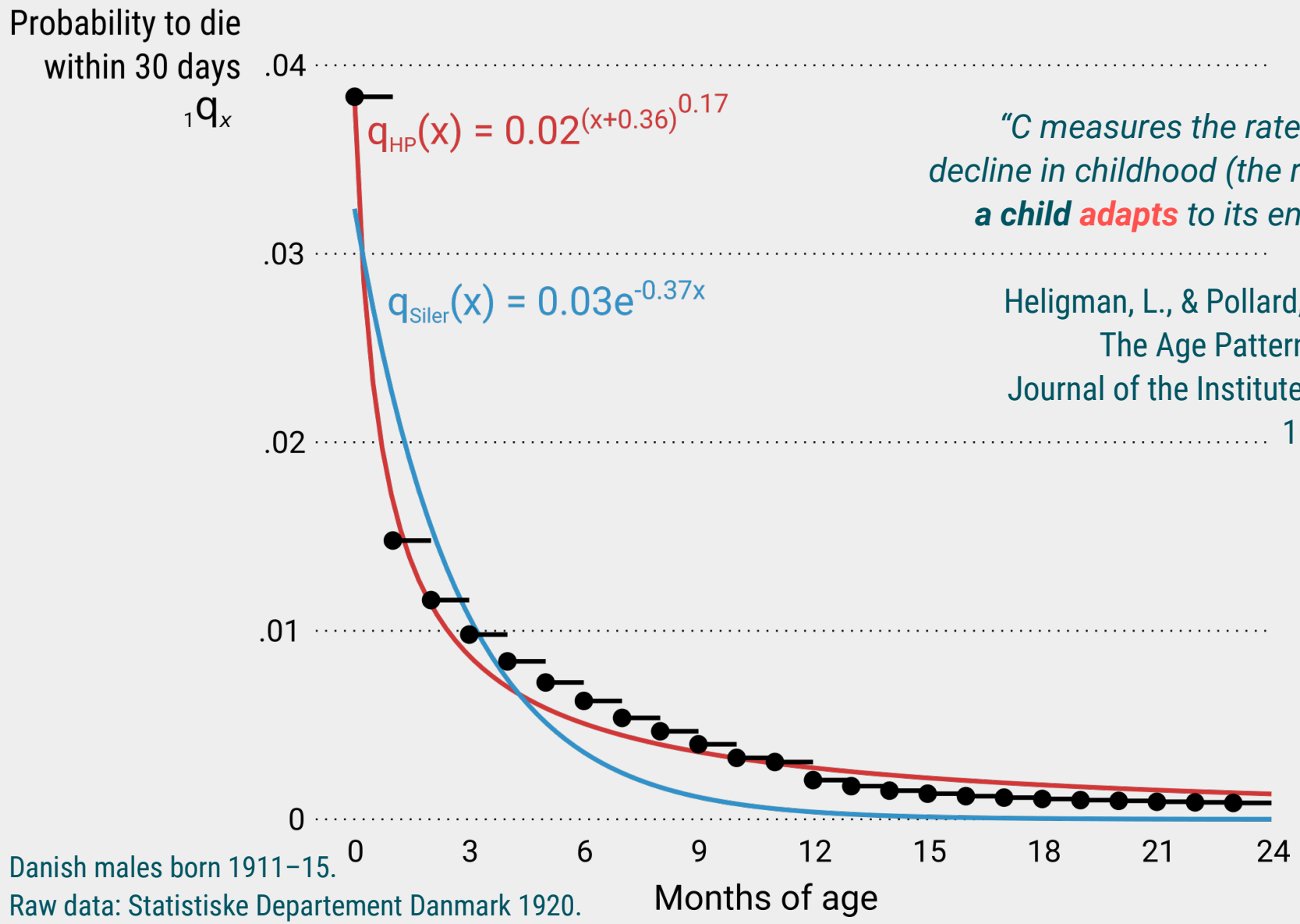


*"While the most common use of this decreasing hazard would be to account for the hazard due to **immaturity**, it can also be used [...] for other hazards to which an animal **adjusts** successfully."*

Siler, W. (1979). A Competing-Risk Model for Animal Mortality. Ecology, 60(4), 750–757.

Danish males born 1911–15.
Raw data: Statistiske Departement Danmark 1920.

Mortality decline as growth and adaptation

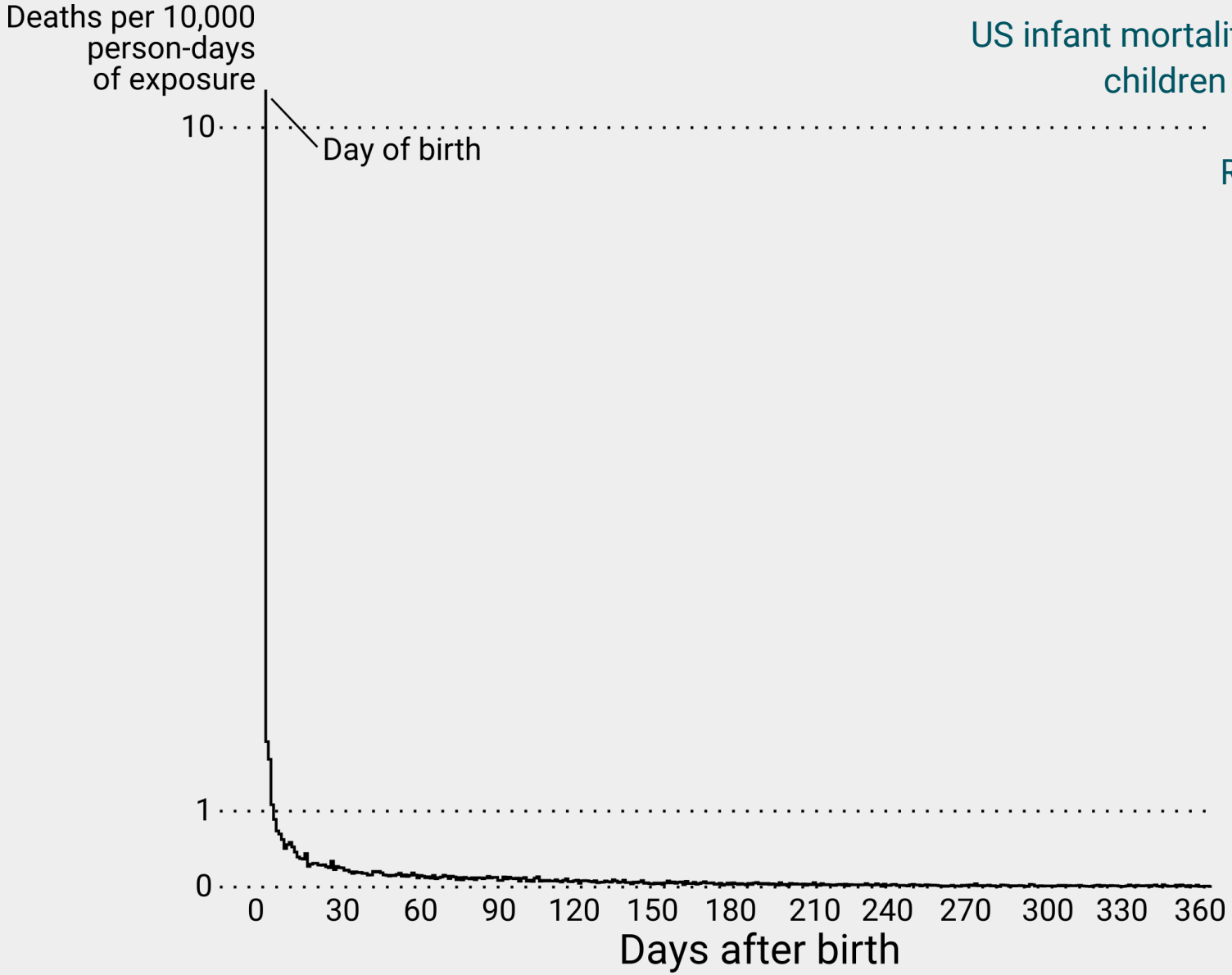


*"C measures the rate of mortality decline in childhood (the rate at which **a child adapts** to its environment)."*

Heligman, L., & Pollard, J. H. (1980). The Age Pattern of Mortality. Journal of the Institute of Actuaries, 107(1), 49–80.

Danish males born 1911–15.
Raw data: Statistiske Departement Danmark 1920.

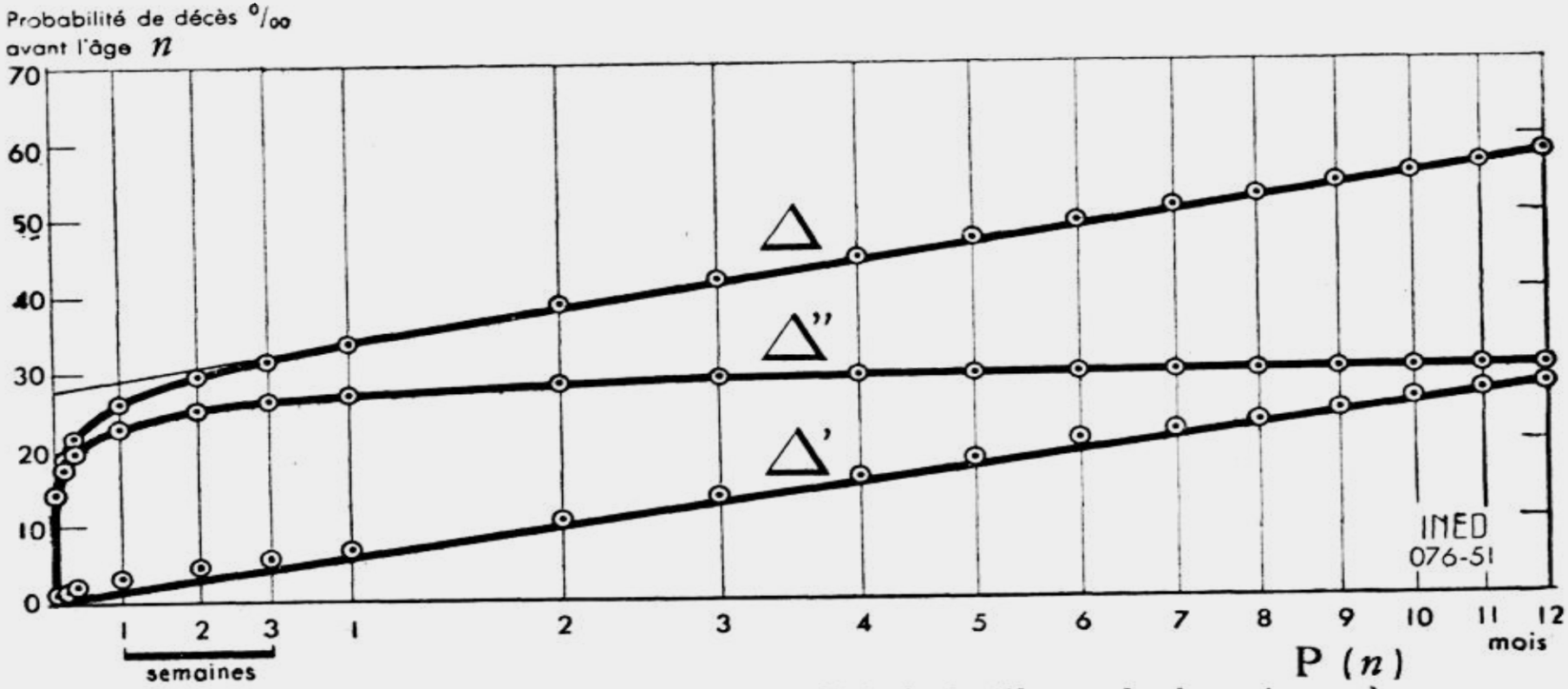
Mortality decline as mortality selection



US infant mortality by day of age for children conceived in 2009.

Raw data: CDC/NCHS.

Mortality decline as mortality selection

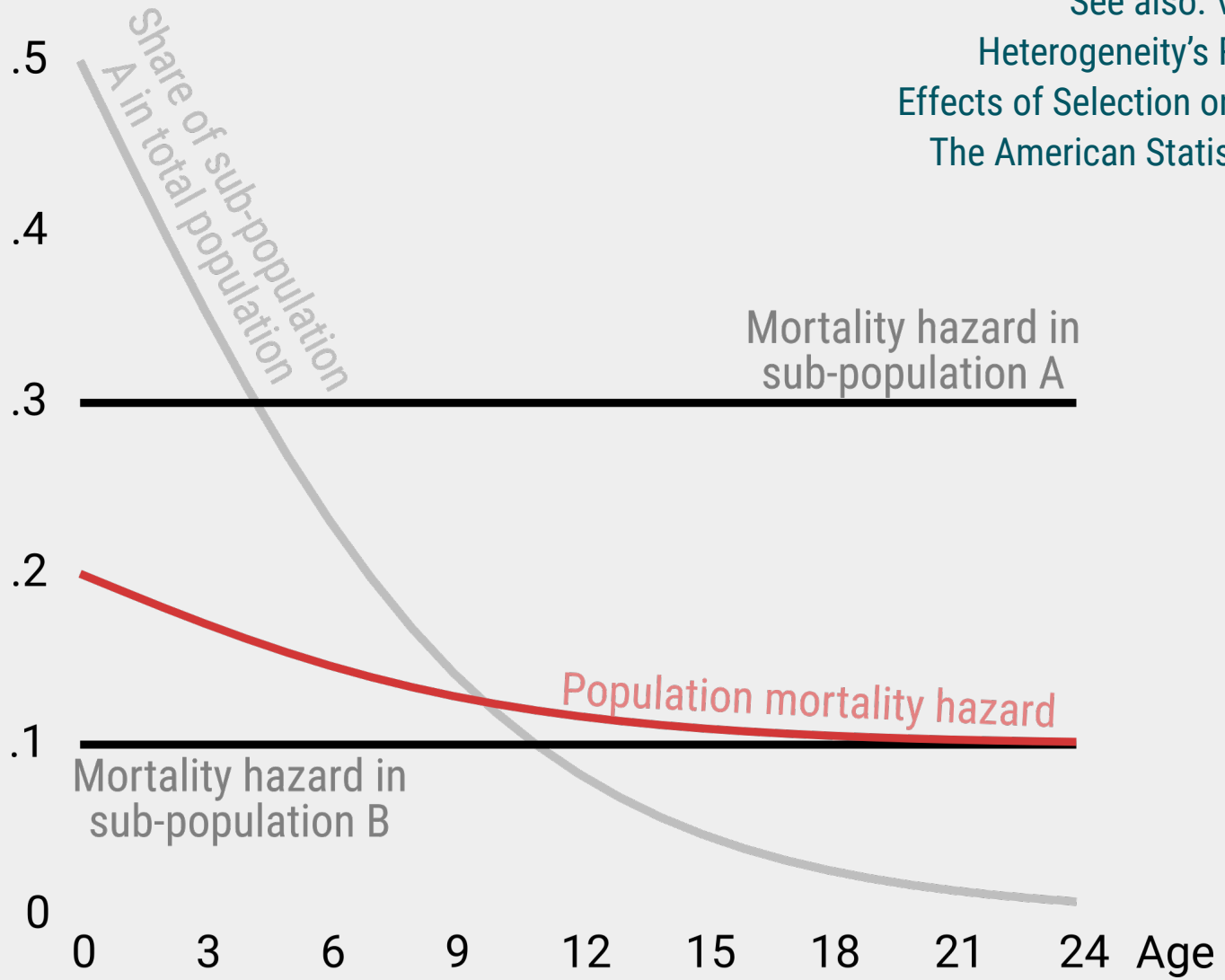


GRAPHIQUE nº 8. — Séparation des mortalités infantiles endogène et exogène. (schéma observé aux Etats-Unis en 1932).

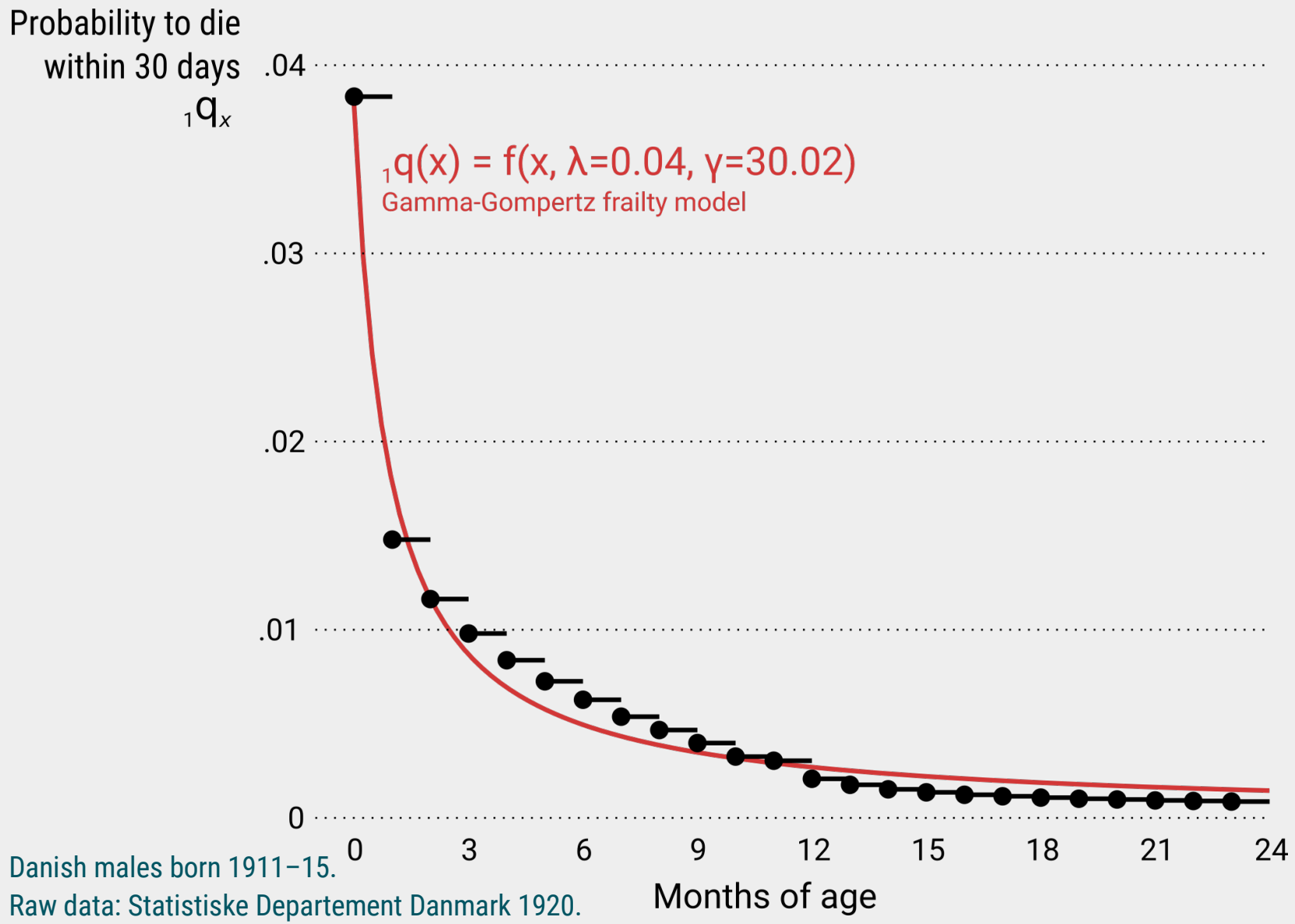
Bourgeois-Pichat, J. (1951). La mesure de la mortalité infantile. II. Les causes de décès. Population, 6(3), 459–480.

Mortality decline as mortality selection

See also: Vaupel & Yashin (1985). Heterogeneity's Ruses: Some Surprising Effects of Selection on Population Dynamics. The American Statistician, 39(3), 176–185.

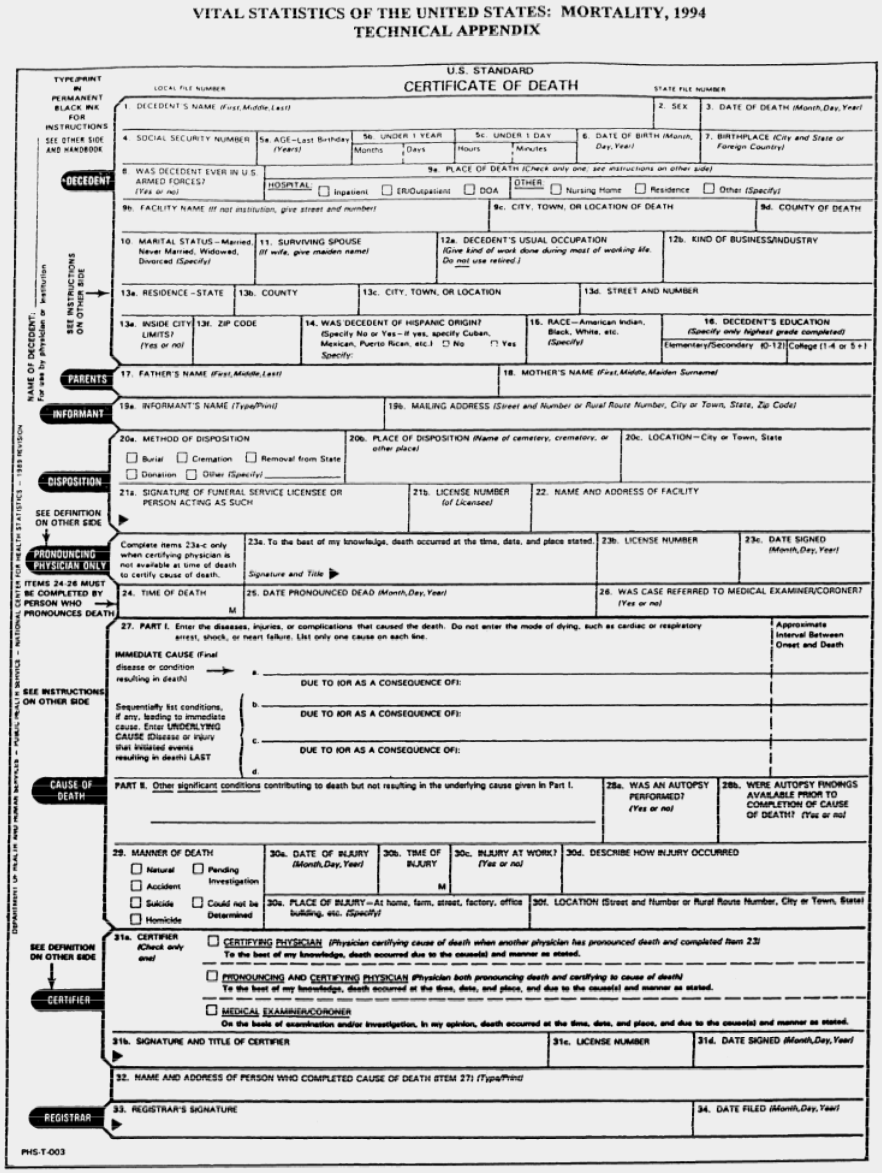


Mortality decline as mortality selection



Danish males born 1911–15.
Raw data: Statistiske Departement Danmark 1920.

Overcoming guesswork by using individual level data

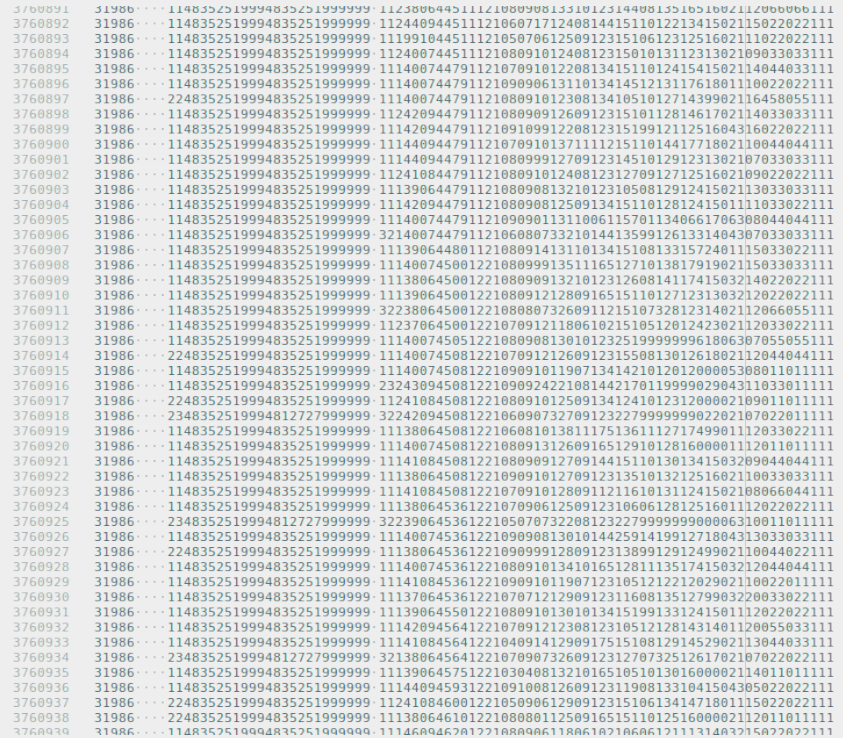


VITAL STATISTICS OF THE UNITED STATES: MORTALITY, 1994
TECHNICAL APPENDIX

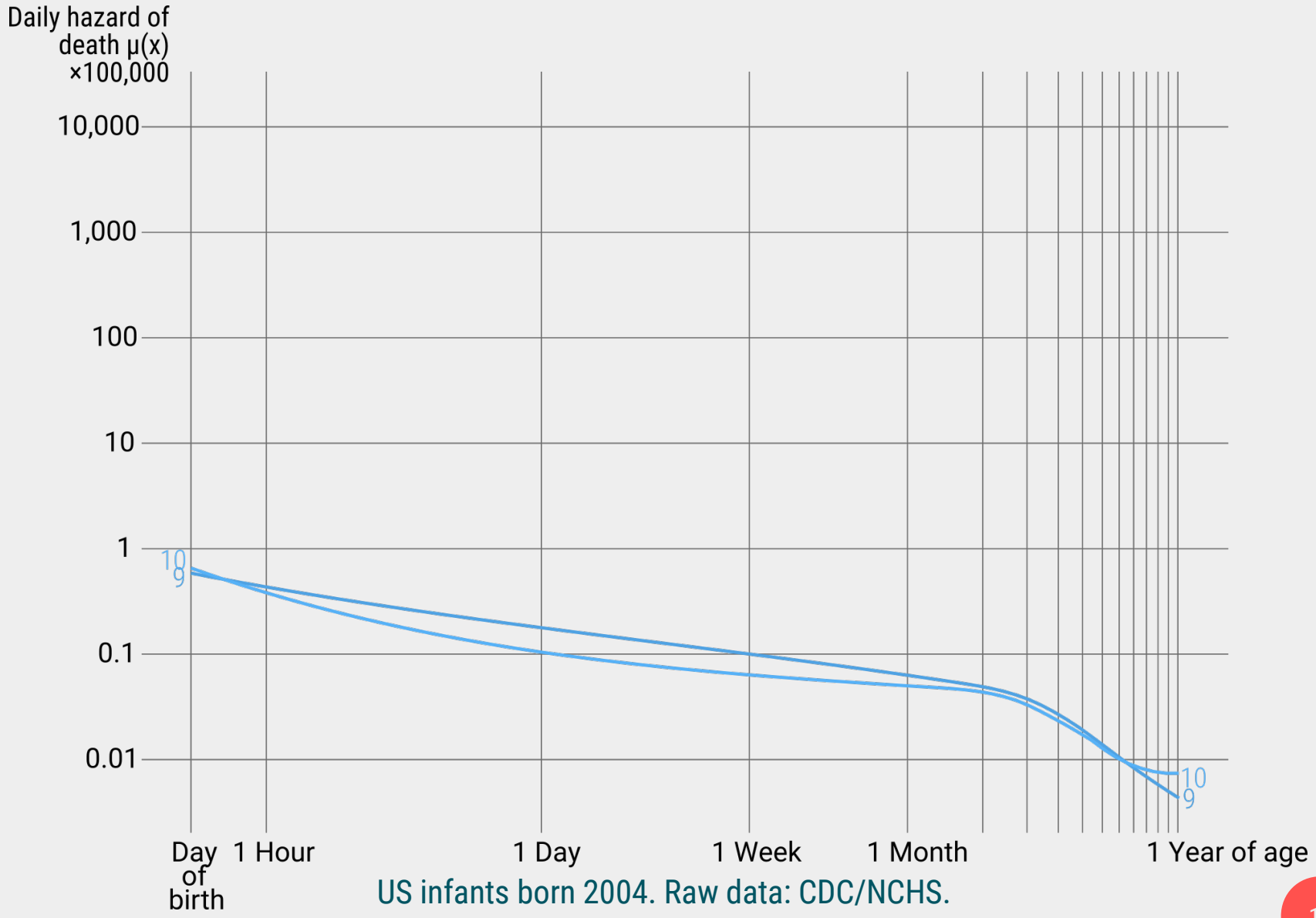
U.S. STANDARD
CERTIFICATE OF DEATH

The NCHS provides:

- birth certificates on **~70 million US births** over period 1995–2010
- death certificates on the 439,215 infant deaths during that time

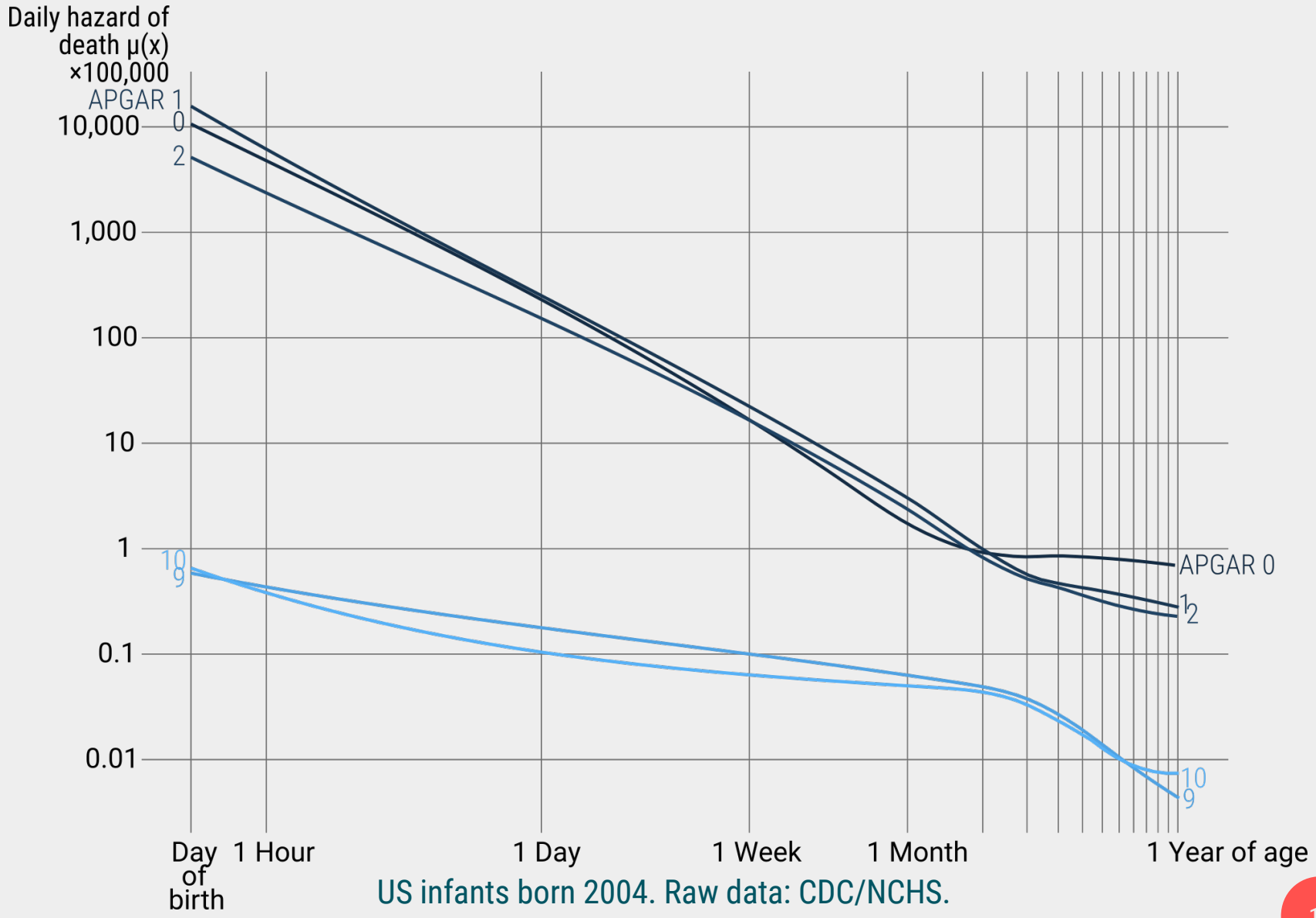


A demonstration of mortality selection



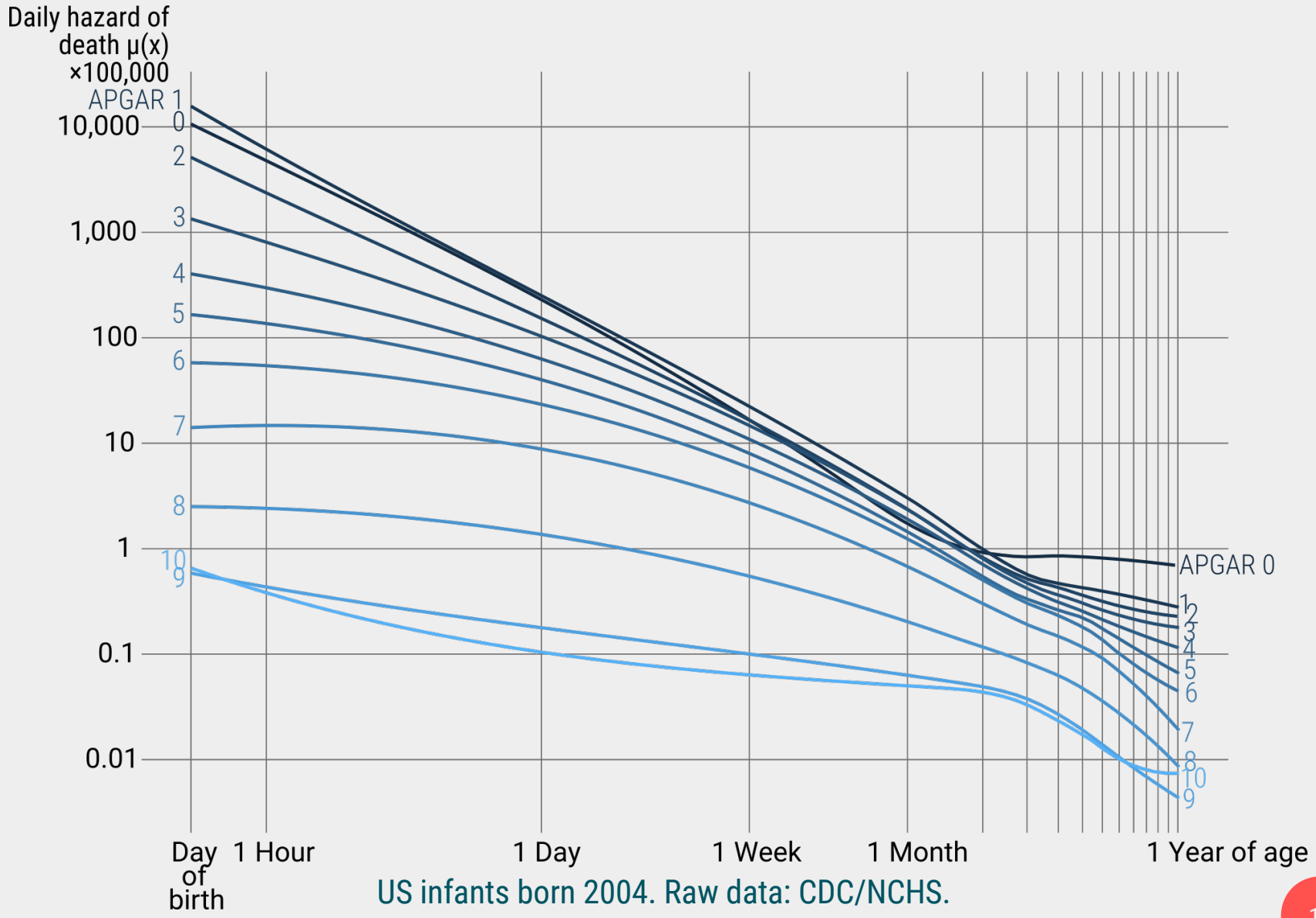
US infants born 2004. Raw data: CDC/NCHS.

A demonstration of mortality selection



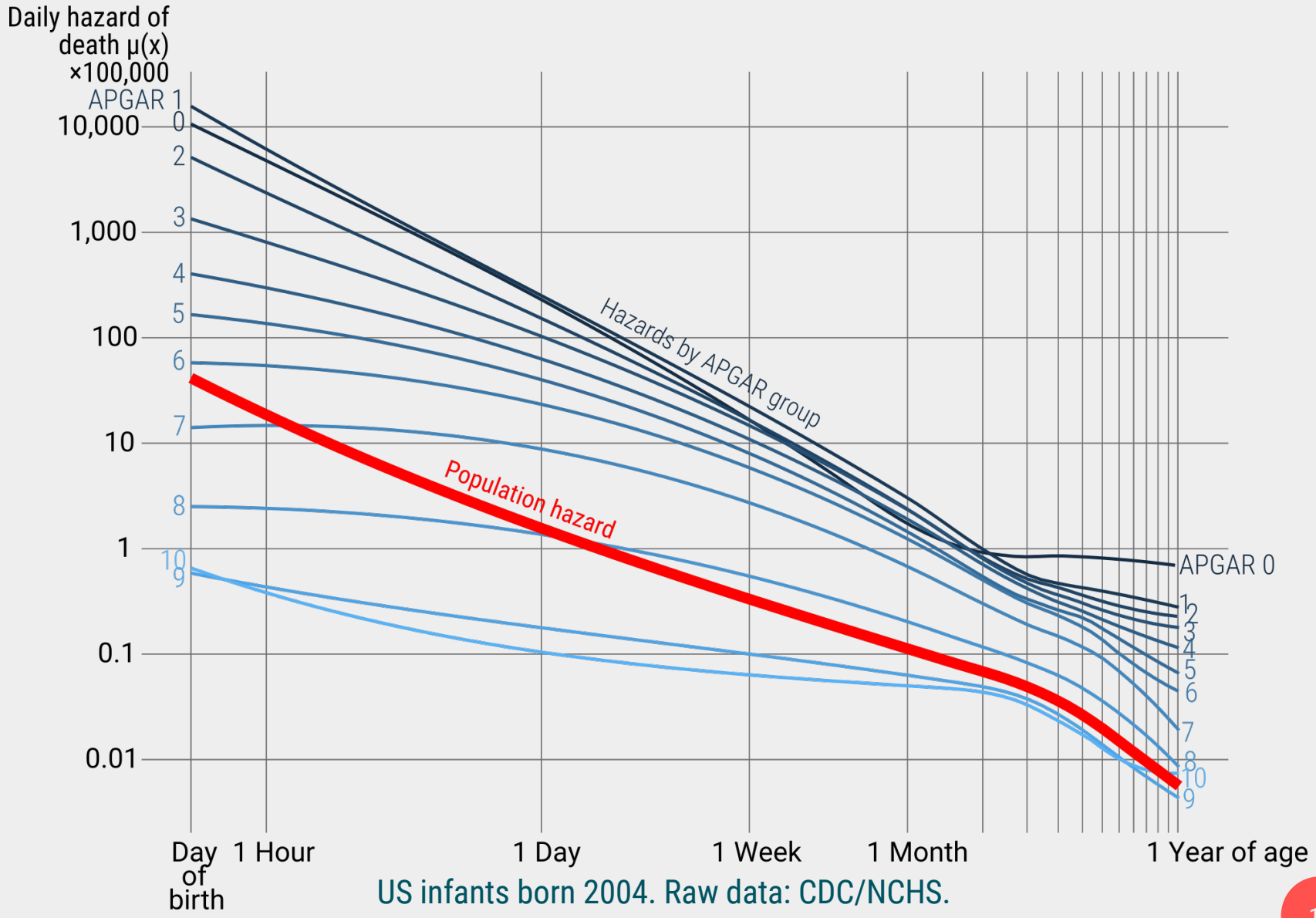
US infants born 2004. Raw data: CDC/NCHS.

A demonstration of mortality selection



US infants born 2004. Raw data: CDC/NCHS.

A demonstration of mortality selection



US infants born 2004. Raw data: CDC/NCHS.

Decomposition methods

$$\underbrace{Y(A)|X_A - Y(B)|X_B}_{\text{Total difference in outcome between groups A and B}} = \underbrace{(A\text{-}B)}_{\text{Difference due to group effect}} + \underbrace{(X_A\text{-}X_B)}_{\text{Difference due to group composition}}$$

Decomposition methods

Vaupel, J. W., & Zhang, Z. (2010). **Attrition in heterogeneous cohorts**. Demographic Research, 23(26), 737–748.

Oaxaca, R. (1973). "**Male-Female Wage Differentials in Urban Labor Markets**". International Economic Review. 14 (3): 693–709.

Price, G. R. (1970). **Selection and covariance**. Nature, 227(5257), 520–1.

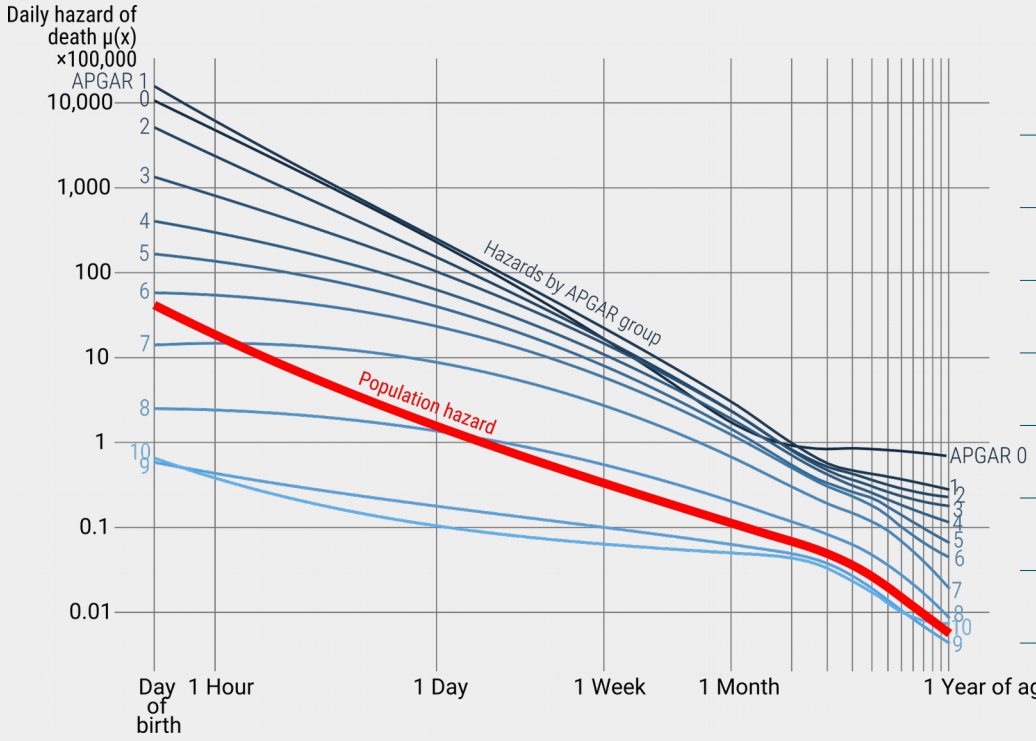
$$\underbrace{Y(A)|X_A - Y(B)|X_B}_{\text{Total difference in outcome between groups A and B}} = \underbrace{(A\text{-}B)}_{\text{Difference due to group effect}} + \underbrace{(X_A\text{-}X_B)}_{\text{Difference due to group composition}}$$

Powers, D. A., Yoshioka, H., & Yun, M.-S. (2011). **mvdcmp: Multivariate decomposition for nonlinear response models.** The Stata Journal, 11(4), 556–576.

Preston, S.H., Himes, C.L., and Eggers, M. (1989). **Demographic conditions responsible for population aging**. Demography 26(4): 691–704.

Vaupel, J.W. and Canudas-Romo, V. (2002). **Decomposing demographic change into direct vs. compositional components**. Demographic Research 7(1): 1–14.

Decomposing the infant mortality age decline



Δμ(x) over	Δμ(x) due to direct change	Δμ(x) due to comp. change	
		absolute	percent
1st hour of life	-6.32E-02	-1.76E-02	**21.8**
Hours 2–24	-4.24E-03	-7.50E-05	1.7
Day 1	-2.28E-04	-4.53E-07	0.2
Day 2	-1.08E-04	-1.04E-07	0
Day 3	-5.88E-05	-5.10E-08	0
Day 4	-3.33E-05	-2.59E-08	0
Day 5	-1.75E-05	-1.29E-08	0

Method: Vaupel, J.W. and Canudas-Romo, V. (2002). Decomposing demographic change into direct vs. compositional components. Demographic Research 7(1): 1–14.

Data: US infants born 2005-10. CDC/NCHS.

Decomposing the infant mortality age decline

Δμ(x) over	total Δμ(x)	% Δμ(x) due to direct change	% Δμ(x) due to compos. change
hour 0 to 24	2.86E-03	39.4	60.6

Method: Poisson regression on infant death counts decomposed using Powers, D. A., Yoshioka, H., & Yun, M.-S. (2011). mvdcmp: Multivariate decomposition for nonlinear response models. The Stata Journal, 11(4), 556–576.

Data: US infants born 2004. CDC/NCHS,

Decomposing the infant mortality age decline

Δμ(x) over	total Δμ(x)	% Δμ(x) due to		share on compositional change				
		direct change	compos. change	sex	birth-weight	birth defect	5 min APGAR	Mother
hour 0 to 24	2.86E-03	39.4	**60.6**	0.00	**0.16**	0.04	**0.80**	0.00

Method: Poisson regression on infant death counts decomposed using Powers, D. A., Yoshioka, H., & Yun, M.-S. (2011). mvdcmp: Multivariate decomposition for nonlinear response models. The Stata Journal, 11(4), 556–576.

Data: US infants born 2004. CDC/NCHS,

Decomposing the infant mortality age decline

Δμ(x) over	total Δμ(x)	% Δμ(x) due to		share on compositional change				
		direct change	compos. change	sex	birth-weight	birth defect	5 min APGAR	Mother
hour 0 to 24	2.86E-03	39.4	**60.6**	0.00	0.16	0.04	0.80	0.00
Day 2 to 7	7.84E-06	85.5	14.5	0.00	0.27	0.13	0.59	0.01
Week 2 to 4	1.72E-06	91.7	8.3	0.00	0.25	0.24	0.49	0.02
Month 2 to 12	1.69E-06	93.7	6.3	0.00	0.52	0.20	0.28	0.00

Method: Poisson regression on infant death counts decomposed using Powers, D. A., Yoshioka, H., & Yun, M.-S. (2011). mvdcmp: Multivariate decomposition for nonlinear response models. The Stata Journal, 11(4), 556–576.

Data: US infants born 2004. CDC/NCHS,

Conclusion

Mortality selection drives the mortality decline immediately after birth

Still, most of the infant mortality decline over age is due to individual level effects.

More on this project

github.com/jschoeley/imort_select

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