



January 15–18, 2023
Orlando, Florida



SOCIETY OF
ACTUARIES®

SOA Antitrust Compliance Guidelines

Active participation in the Society of Actuaries is an important aspect of membership. While the positive contributions of professional societies and associations are well-recognized and encouraged, association activities are vulnerable to close antitrust scrutiny. By their very nature, associations bring together industry competitors and other market participants. The United States antitrust laws aim to protect consumers by preserving the free economy and prohibiting anti-competitive business practices; they promote competition. There are both state and federal antitrust laws, although state antitrust laws closely follow federal law. The Sherman Act, is the primary U.S. antitrust law pertaining to association activities. The Sherman Act prohibits every contract, combination or conspiracy that places an unreasonable restraint on trade. There are, however, some activities that are illegal under all circumstances, such as price fixing, market allocation and collusive bidding.

There is no safe harbor under the antitrust law for professional association activities. Therefore, association meeting participants should refrain from discussing any activity that could potentially be construed as having an anti-competitive effect. Discussions relating to product or service pricing, market allocations, membership restrictions, product standardization or other conditions on trade could arguably be perceived as a restraint on trade and may expose the SOA and its members to antitrust enforcement procedures.

While participating in all SOA in person meetings, webinars, teleconferences or side discussions, you should avoid discussing competitively sensitive information with competitors and follow these guidelines:

- **Do not** discuss prices for services or products or anything else that might affect prices
- **Do not** discuss what you or other entities plan to do in a particular geographic or product markets or with particular customers.
- **Do not** speak on behalf of the SOA or any of its committees unless specifically authorized to do so.
- **Do** leave a meeting where any anticompetitive pricing or market allocation discussion occurs.
- **Do** alert SOA staff and/or legal counsel to any concerning discussions
- **Do** consult with legal counsel before raising any matter or making a statement that may involve competitively sensitive information.

Adherence to these guidelines involves not only avoidance of antitrust violations, but avoidance of behavior which might be so construed. These guidelines only provide an overview of prohibited activities. SOA legal counsel reviews meeting agenda and materials as deemed appropriate and any discussion that departs from the formal agenda should be scrutinized carefully. Antitrust compliance is everyone's responsibility; however, please seek legal counsel if you have any questions or concerns.

Presentation Disclaimer

Presentations are intended for educational purposes only and do not replace independent professional judgment. Statements of fact and opinions expressed are those of the participants individually and, unless expressly stated to the contrary, are not the opinion or position of the Society of Actuaries, its cosponsors or its committees. The Society of Actuaries does not endorse or approve, and assumes no responsibility for, the content, accuracy or completeness of the information presented. Attendees should note that the sessions are audio-recorded and may be published in various media, including print, audio and video formats without further notice.



SESSION 5B: Aging Process

January, 17, 2023

Moderator:

Sam Gutterman, FSA, CERA, FCA,
FCAS, HONFIA, MAAA

Presenters:

Roland Rau

Can Health Shocks Alter the Rate of Aging?

ROLAND RAU

IN COLLABORATION WITH

MARCUS EBELING, KARIN MODIG, ANDERS AHLBOM, HÅKAN MALMSTRÖM

January 17, 2023



**Karolinska
Institutet**

MAX PLANCK INSTITUTE
FOR DEMOGRAPHIC
RESEARCH



**Universität
Rostock**

Traditio et Innovatio

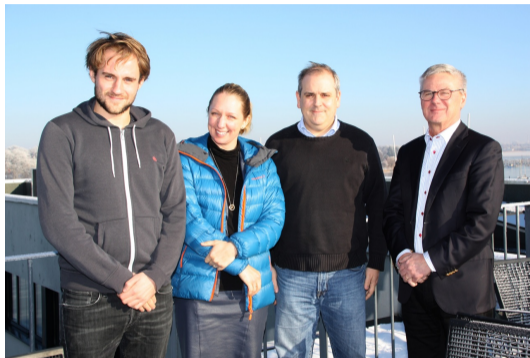
The so-called “*b* hypothesis” by Vaupel

Hence,
I propose the hypothesis that
all older humans have a similar,
and perhaps essentially the same,
rate of increase in mortality with age.
I believe that this
should be tested.

James W. Vaupel (2010, p. 539)



Our Goal: Test and reject the b hypothesis



Picture taken by Dirk Viereg

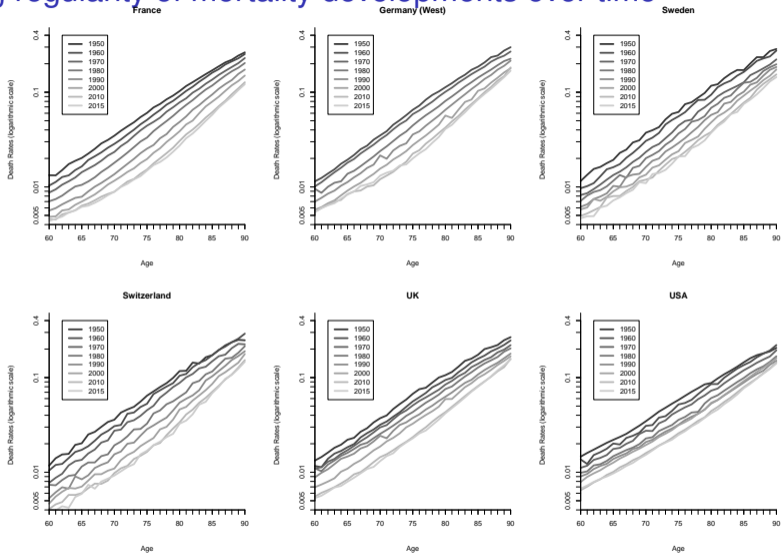
Marcus Ebeling
Karin Modig
Roland Rau

MPIDR, Karolinska Institutet
Karolinska Institutet
U Rostock, MPIDR

Anders Ahlbom
Håkan Malmström

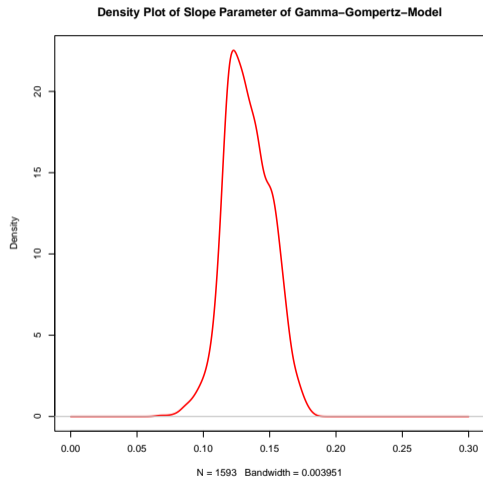
Karolinska Institutet
Karolinska Institutet
(not in picture)

The amazing regularity of mortality developments over time



See, for instance, Rau and Vaupel (2014) for a similar plot.

The amazing regularity of mortality developments over time



- ▶ Density of slope b for women in 24 countries of the HMD.
- ▶ IQR for b : 0.121—0.147

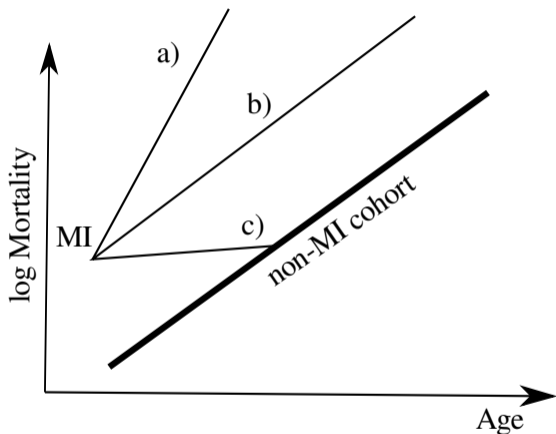
-
- ▶ Ages 80–100 used for estimation
 - ▶ Countries used AUS, AUT, BEL, CAN, CHE, DEU, DNK, ENW, ESP, FIN, FRA, FRG, GBR, GDR, ISR, ITA, JPN, NLD, NOR, NZN, POL, PRT, SWE, USA.
 - ▶ 1593 estimates (see N on the bottom of left panel).
 - ▶ Actual estimation via Poisson MLE of Gamma-Gompertz-Model (parametrized using the mode — see Equation 39 of Vaupel and Missov (2014))

But what happens after a health shock?

Our definition of health shocks:

- ▶ (First) Myocardial Infarction
- ▶ (First) Cancer Diagnosis
- ▶ Getting Diagnosed with Diabetes

But what happens after a health shock?



- a) **a** accelerating pace of mortality increase
- b) **b** hypothesis is supported
- c) **c** convergence towards non-affected cohort

... and will it be the same for all three “health shocks” we used?

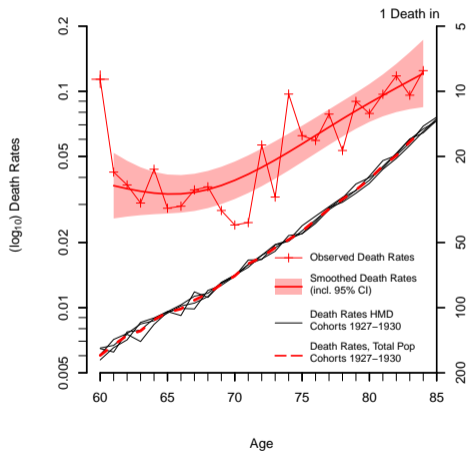
Our Study Population: Swedish Birth Cohorts 1927–1930

Diagnosis (“DX”)	Sex	Age at DX	Ages Follow-Up	Number of Cases	Number of Deaths
Myocardial Infarction ¹	F	60	61-87	320	56
	M	60	61-87	1,083	905
Cancer ¹	F	70	71-87	645	452
	M	70	71-87	1,218	882
	F	60	61-87	1,246	844
	M	60	61-87	1,189	847
Diabetes ²	F	70	71-87	1,703	1,046
	M	70	71-87	2,418	1,669
	F	< 61	61-87	610	348
	M	< 61	61-87	1,274	844
	F	< 71	71-87	1,561	600
	M	< 71	71-87	2,700	1,222

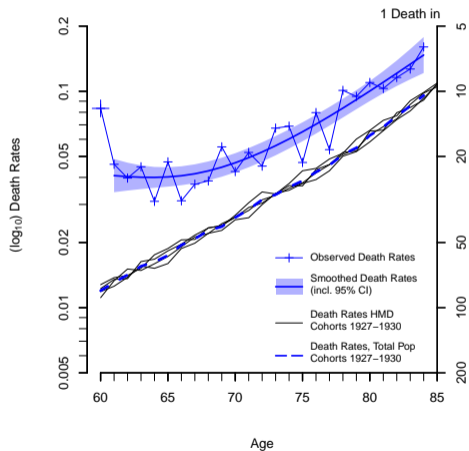
¹ Nationwide Swedish Register, ² AMORIS Cohort = primarily Stockholm

Results: MI

Myocardial Infarction, Women

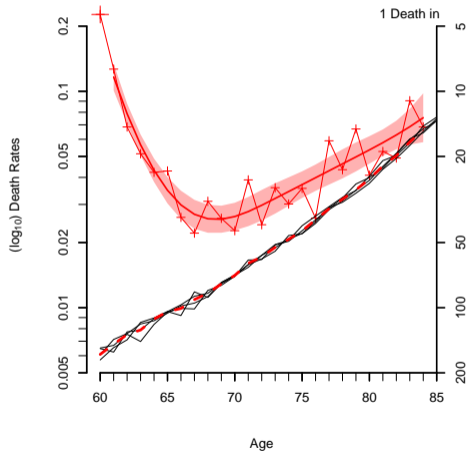


Myocardial Infarction, Men

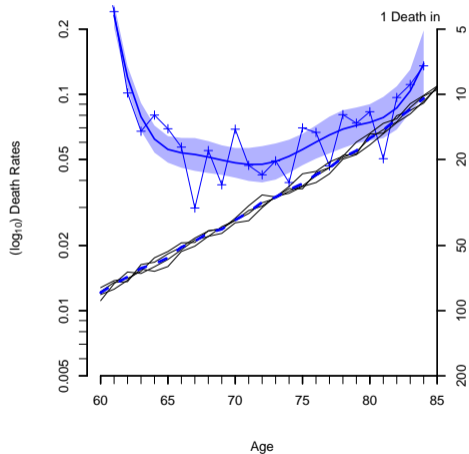


Results: Malignant Neoplasms / Cancer

Malignant Neoplasms, Women

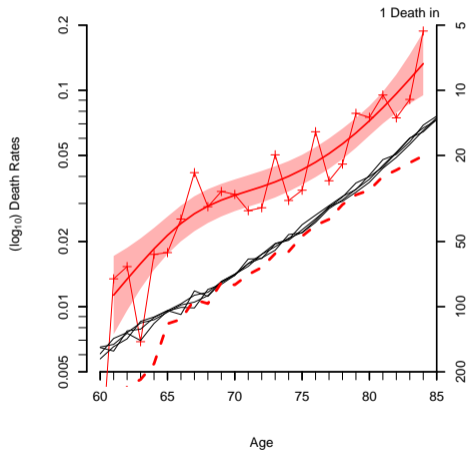


Malignant Neoplasms, Men

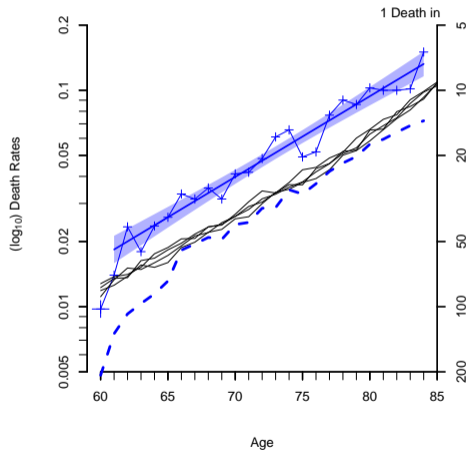


Results: Diabetes

Diabetes, Women



Diabetes, Men



Conclusions:

- ▶ Our goal was to test/reject the b hypothesis, i.e. that the rate of aging is some kind of “biological constant”.
- ▶ Idea: What happens after a health shock? Still the same rate? Or maybe decelerating? Or maybe accelerating?
- ▶ Health shocks shown here: First myocardial infarction, getting diagnosed with cancer.
- ▶ Our in the case of a chronic disease (diabetes)?
- ▶ Data: Swedish register data (population register & patient register) for birth cohorts 1927–1930.
- ▶ Our main results:
 - ▶ Mortality trajectory remains rather parallel even after health shock (MI, diabetes).
 - ▶ Convergence towards the unaffected population in the case of cancer.
 - ▶ No accelerated aging.

Thank you very much for your attention!

Ebeling M, Rau R, Malmström H, Ahlbom A, Modig K (2021):

The rate by which mortality increase with age is the same for those who experienced chronic disease as for the general population.

Age and Ageing 50 (5): 1633–1640.

Cited Literature

Ebeling, M., R. Rau, H. Malmström, A. Ahlbom, and K. Modig (2021). The rate by which mortality increase with age is the same for those who experienced chronic disease as for the general population. *Age and Ageing* 50(5), 1633–1640.

Rau, R. and J. W. Vaupel (2014). The changing demographic context of aging. In T. B. Kirkwood and C. L. Cooper (Eds.), *Wellbeing: A Complete Reference Guide, Wellbeing in Later Life*, Volume 4, pp. 9–29. John Wiley & Sons.

Vaupel, J. and T. I. Missov (2014). Unobserved population heterogeneity: A review of formal relationships. *Demographic Research* 31(22), 659–686.

Vaupel, J. W. (2010). Biodemography of human aging. *Nature* 464, 536–542.

Universität
Rostock



Traditio et Innovatio



Karolinska
Institutet

MAX PLANCK INSTITUTE
FOR DEMOGRAPHIC
RESEARCH

