General Sesssion VIII – Panel: What's on the Horizon of Aging Research and What Does it Mean to Actuaries?

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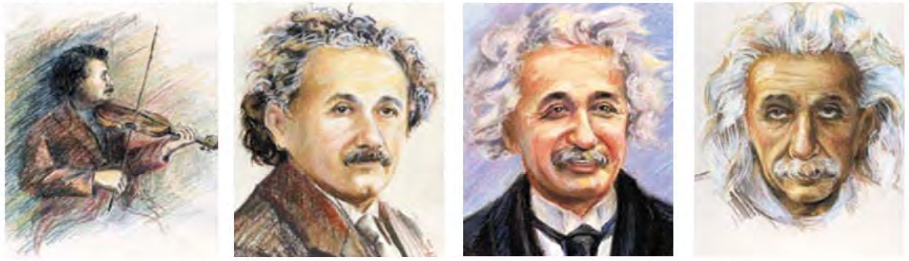


Staying healthy as we get older!

What's on the Horizon of Aging Research
and What Does it Mean to Actuaries?

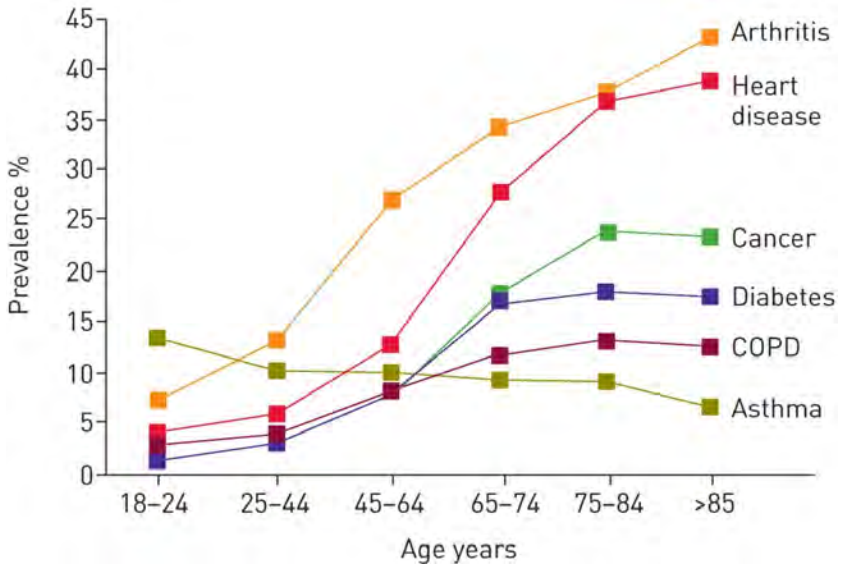
Living to 100 Symposium

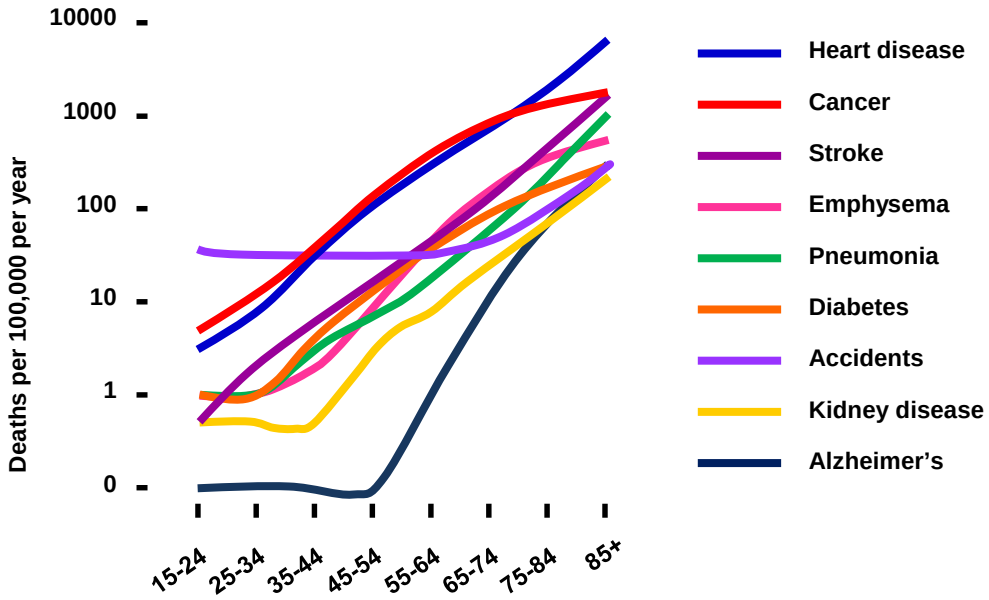
FLEISCHER INSTITUTE for Diabetes & Metabolism

Montefiore EINSTEIN

Sofiya Milman, MD, MSc

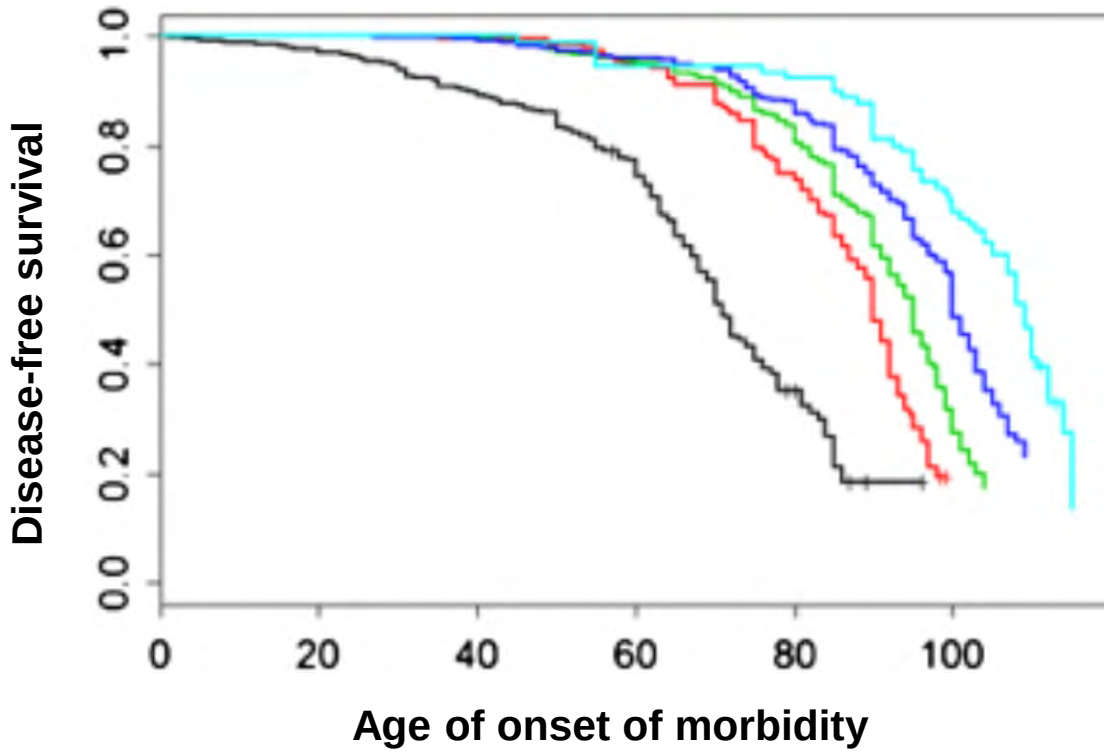
Aging is a Major Risk for Prevalence of and Death from Age-related Diseases





MacNee W et al. Eur Respir J 2014;44:1332-1352; www.cdc.gov

Centenarians delay the onset of age-associated diseases

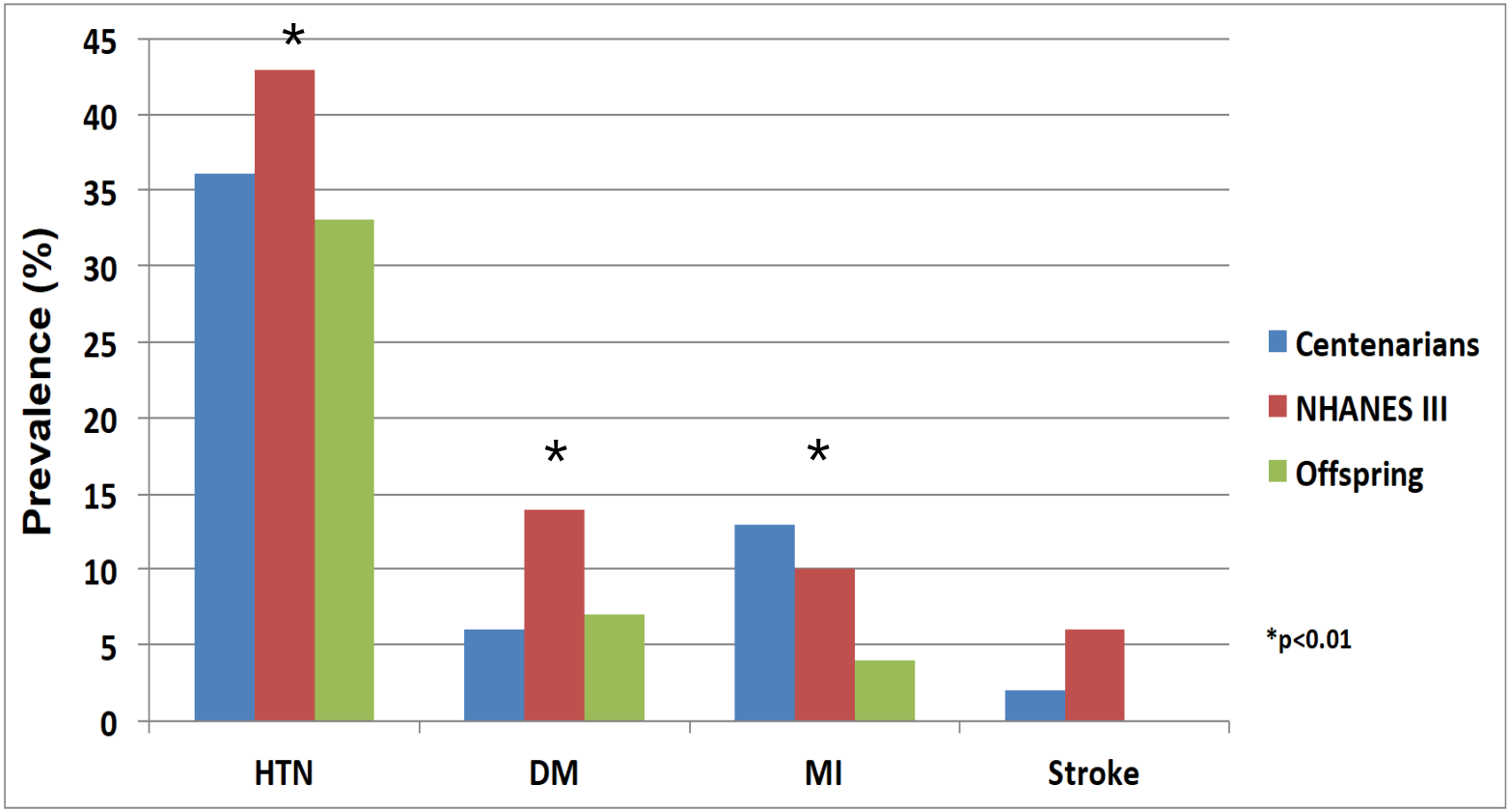


Andersen et al. J Gerontol A Biol Sci Med Sci 2012

Meet our centenarians:
Cover of PLoS Biology April 2006

90 years earlier

Centenarians and their offspring have lower prevalence of age-related diseases



Atzmon et al. *J Am Geriatr Soc* 2004

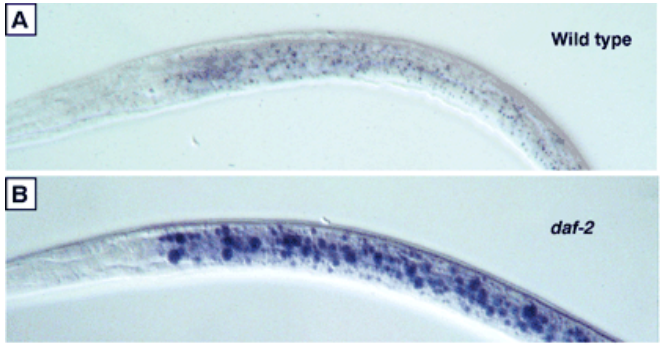
Lifestyle in offspring and controls

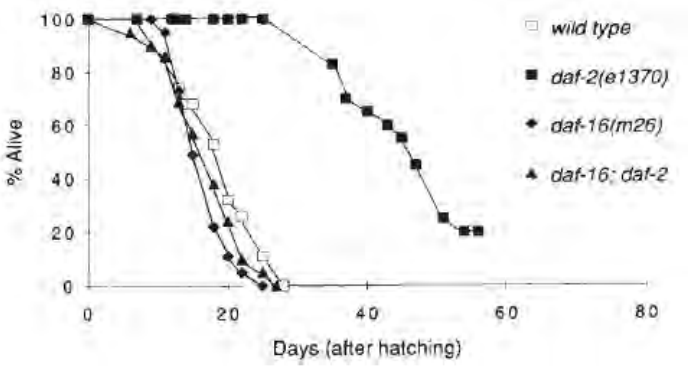
Lifestyle factor	Offspring n=395	Controls n=450	p-value
Age (years)	75±6	76±7	
BMI (kg/m^2)	28±5	28±5	0.34
Education (years)	17±3	17±3	0.55
Social strata score	56 (28-66)	56 (28-66)	0.76
Tobacco, ever (%)	55	54	0.80
Alcohol, past year (%)	90	88	0.32
Drinks/week age >50	2 (2-3)	2 (2-3)	0.43
Strenuous activity/wk	3 (0-4)	3 (0-4)	0.71
Blocks walked/day	11 (3-20)	12 (3-20)	0.68

Gubbi S et al. Am J Cardiol 2017

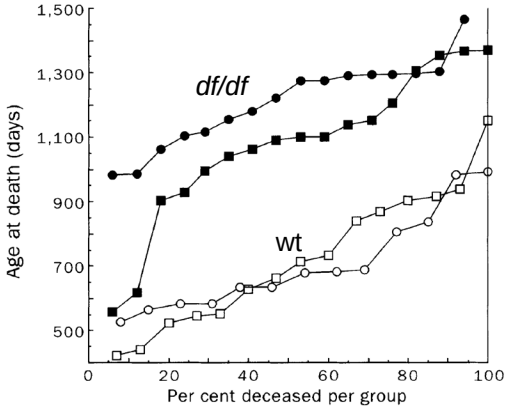
Diminished GH/IGF-I action is a conserved mechanism for longevity across nature

Caenorhabditis elegans

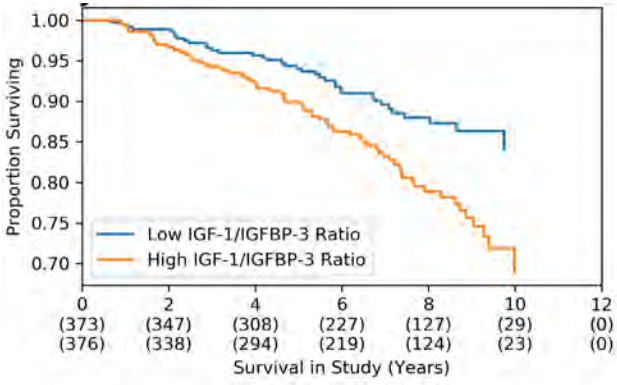




Mus musculus

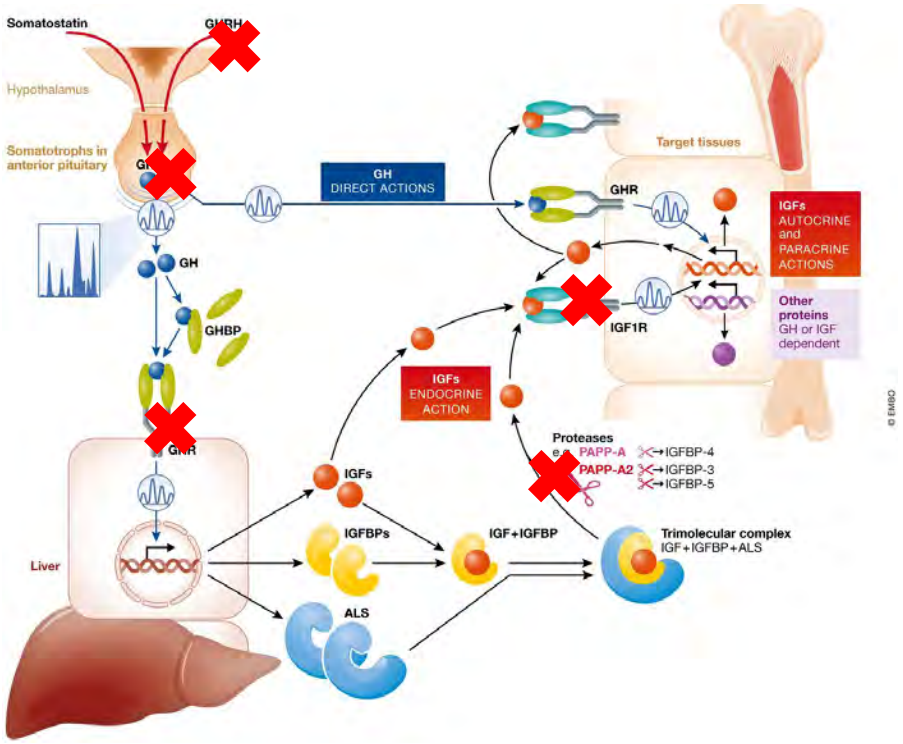


Homo sapiens



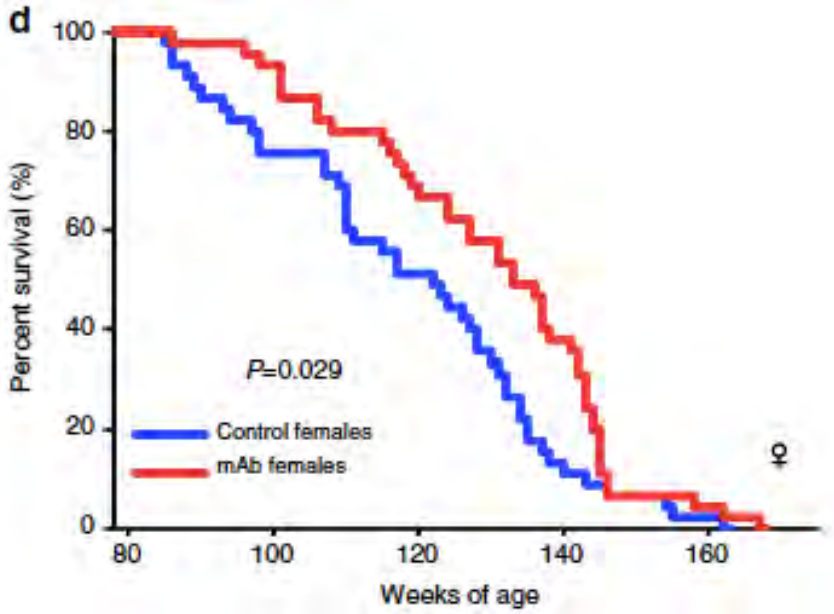
Kenyon C et al. Nature 1993; Kimura K et al. Science 1997; Clancy DJ et al. Sciece 2001; Brown-Borg HM et al. Nature 1996

Inhibition of GH/IGF-I signaling extends lifespan



Argente J et al. EMBO Mol Med. 2017

Treatment with anti-IGF1R mAb



Mao K et al., Nat Comm 2018

What's on the horizon of Aging Research?

- Targeting "pro-aging" biological pathways to delay aging
  - Delay age-related diseases
  - May extend lifespan

- From animal studies to Clinical Trials
  - Metformin
  - Acarbose
  - Rapamycin/analogs
  - Senolytics

Targeting Aging with METformin Trial (TAME)

- Studies show that metformin may influence metabolic and cellular processes that control aging and are associated with age-related conditions
- TAME is a proof-of-concept clinical trial designed to test the hypothesis that aging can be treated

Coming soon!

Adapted from AFAR

Acknowledgements

Longevity Research Teams

Colleagues and Collaborators

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afar american federation for aging research

The Longevity Dividend

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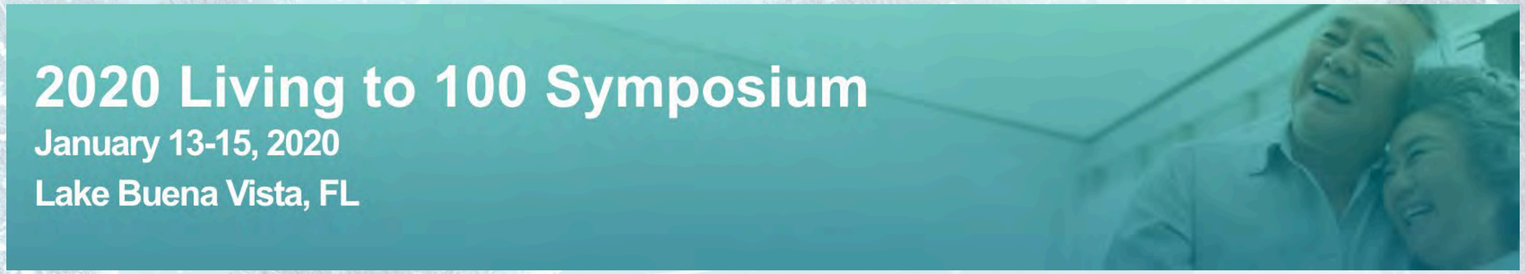
University of Illinois at Chicago

Co-founder and Chief Scientist
Lapetus Solutions

Scientific Advisory Board
American Federation for Aging Research and PepsiCo



LAPETUS
LIFE EVENT SOLUTIONS

UIC SCHOOL OF PUBLIC HEALTH
UNIVERSITY OF ILLINOIS AT CHICAGO

Faust's Bargain

- Faust is disillusioned with his own limits to knowledge -- turns to suicide.
- Mephistopheles makes Faust an offer. Faust's soul in exchange for unlimited knowledge and continuous youthful vigor.
- The story of Faust is a metaphor for a bargain that at first seems appealing, but with time is revealed to be a ruse.

The First Longevity Bargain

The Offer

- Declines in infant and child mortality
- 30 years added to life expectancy at birth
- Most get to survive past age 65

The Price

- Heart disease, cancer, stroke, Alzheimer's, etc.
- Dramatic increase in all fatal and disabling conditions of aging
- An insatiable thirst for more longevity

The Latest Longevity Bargain

The Offer

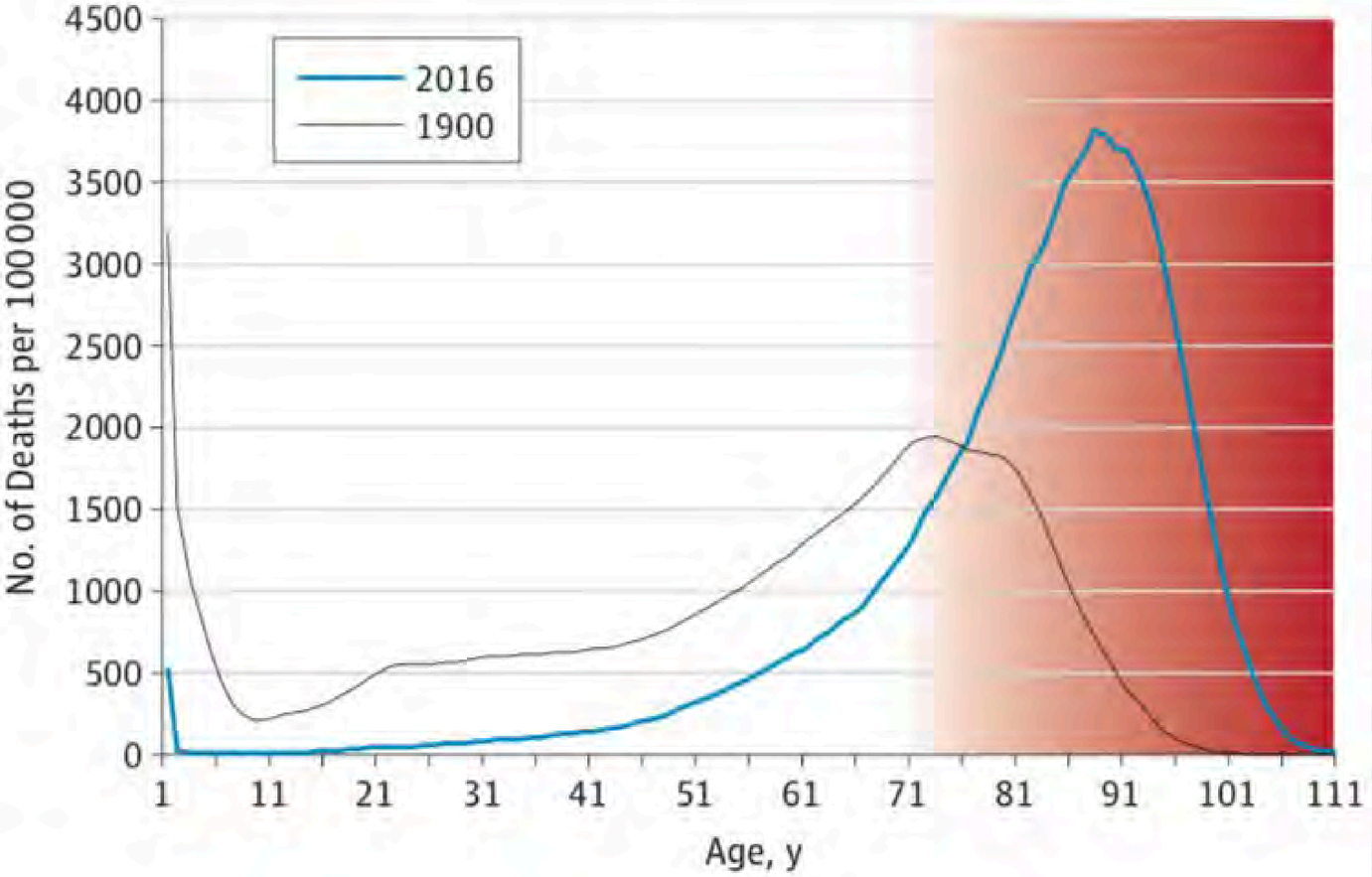
- Reductions in cancer, stroke, and heart disease
- Incrementally smaller gains in longevity (weeks and months)
- Decelerating increases in life expectancy
- Additional survival into extreme old age

The Price

- Our fears about Alzheimer's disease and other neurological conditions rising dramatically come true
- Increased prevalence and duration of frailty and disability
- The Failures of Success becomes reality

What Have We Done to Ourselves?

Figure. Age Distribution of Life Table Deaths for Women in the United States, per 100 000 People, 1900 and 2016



The red zone represents a period in life when the risk of frailty and disability begins to increase rapidly. The goal of aging science is to delay and compress the red zone, which may extend healthy life. Sources: 1900 data from Bell and Miller[1]; 2016 data from Human Mortality Database.[2]

Olshansky, S.J. 2018. *JAMA* 320(13):1323-1324

Socio-economic differences in mortality: Implications for the future of mortality analysis

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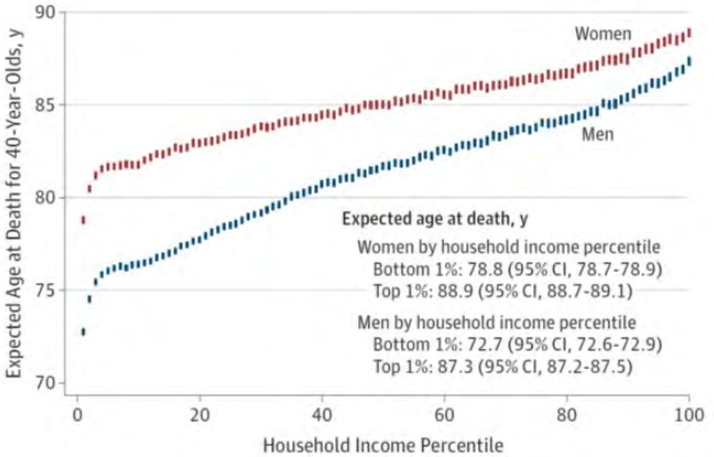
15 January 2020, Living to 100 Symposium
Orlando, Florida

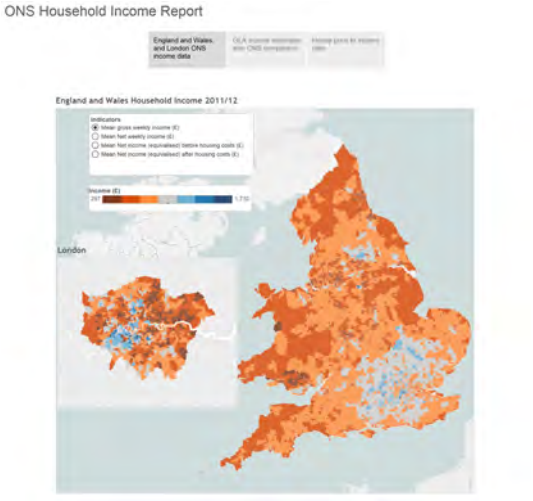
Period Life Expectancy by Lifetime Income in the USA at age 40, 2001-2014

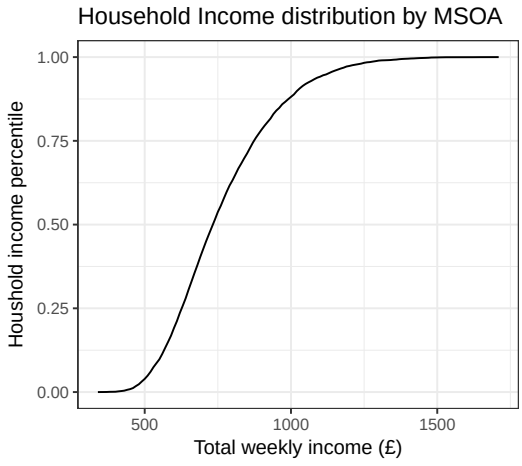


Source: Chetty et al. (2016)

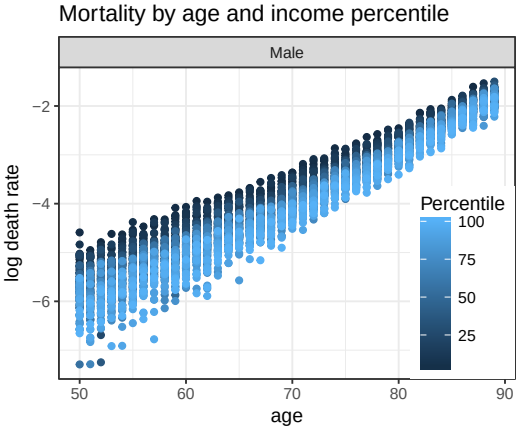
Mortality by Income in England and Wales

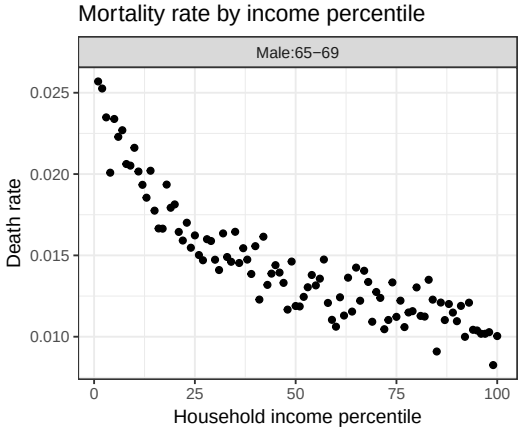
Weekly household income by Middle Layer Super Output Area (MSOA)



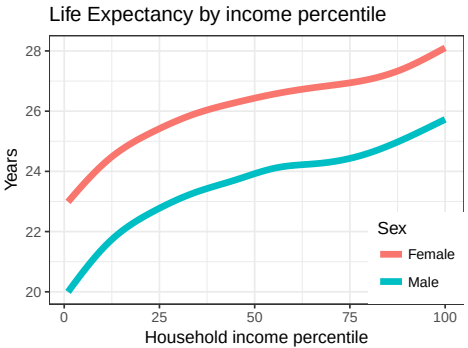


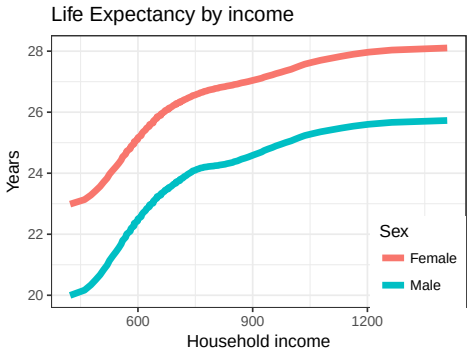
Mortality by Income in England and Wales: Males 2015



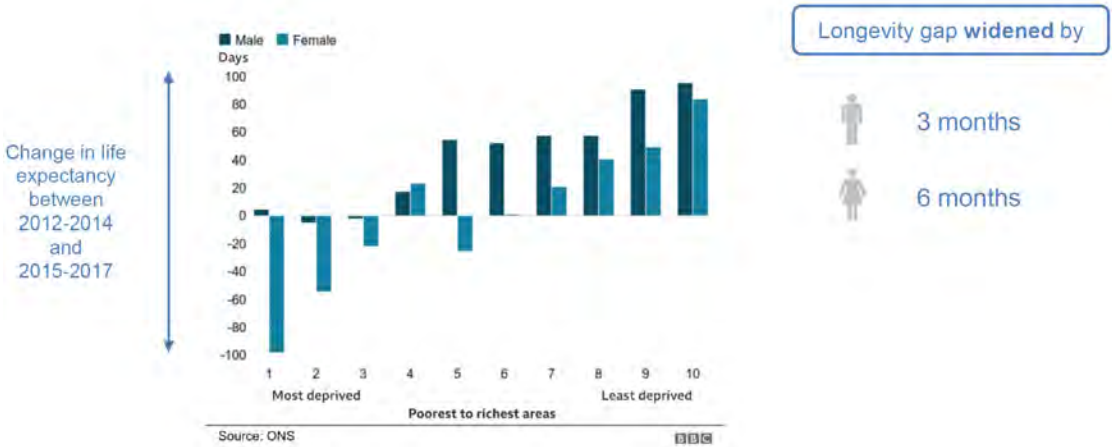


Cohort Life Expectancy by Income in England and Wales: Males age 65 in 2016



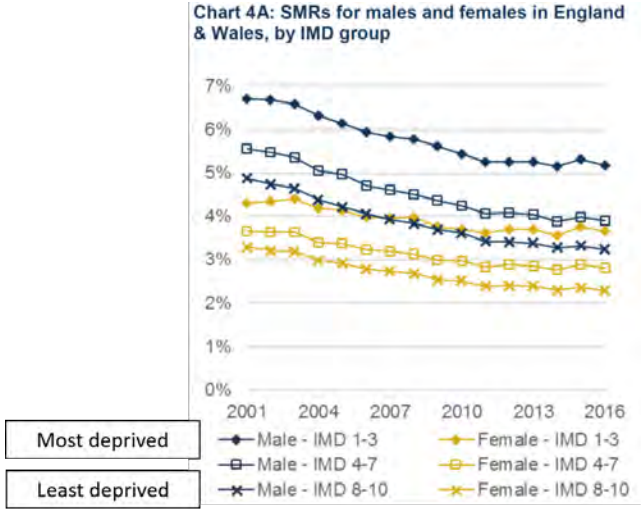


Latest trend in Period Life Expectancy at birth by Deprivation (England)



Source: BBC News version (https://www.bbc.co.uk/news/health-47721167) of ONS data analysis published on 27 March 2019 https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/healthinequalities/bulletins/healthstatelifeexpectanciesbyindexofmultipledeprivationimd/2015to2017

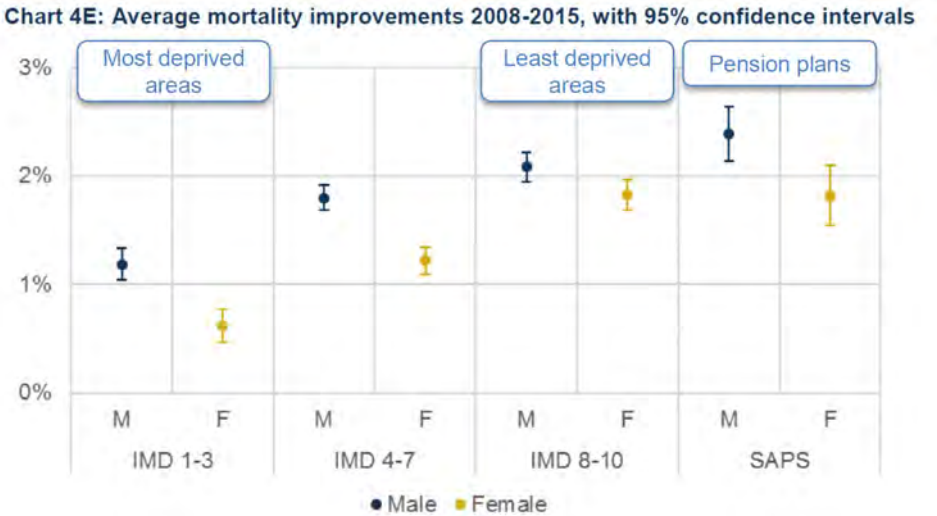
Standardised Mortality Rate by Deprivation (age 65-89)



Source: CMI (2019)

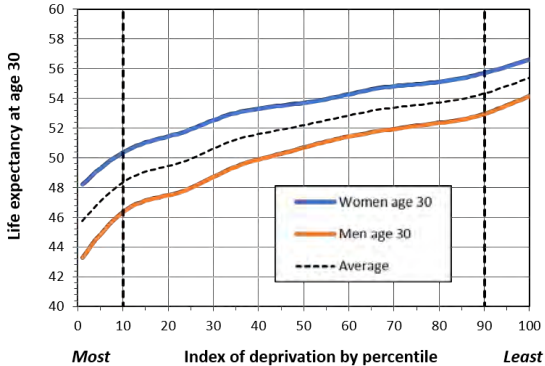
- Mortality rates improvements have slowdown in recent years
- This is more marked for most deprived areas
- Increase in mortality for females in the most deprived areas between 2011 and 2016

Mortality improvement rates by Deprivation (age 65-89)



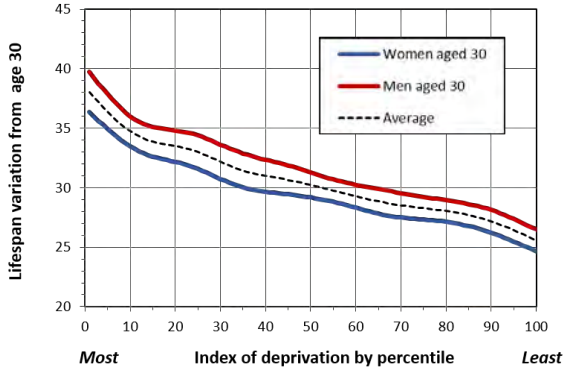
Source: CMI (2019)

Period life expectancy at age 30 in 2015 in England by deprivation percentile



Source: Mayhew, Harper, and Villegas (2018)

Variation in lifespan at age 30 in 2015 in England by deprivation percentile



Source: Mayhew, Harper, and Villegas (2018)

Variation in lifespan = Difference in years between the age to which 90% of the population survive and the age of the top 5% of survivors for people that have attained the age of 30

Summing up...

- There are significant differences in life expectancy and mortality across socio-economic groups measured by different markers (income, deprivation, education, etc)
- Significant differences in mortality:
  - levels
  - trends
  - variability
- Differences are likely to continue to increase

Implications of heterogeneity in mortality

These socio-economic difference have important implications on social and financial planning

- Design of policies for tackling social inequalities
- Setting appropriate mortality assumptions for annuities/pensions
- Implications for the redistribution of pensions programs
- Design of longevity risk management strategies

Implications for the future of mortality analysis

- Facilitate the timely **availability of mortality data** by socio-economic group
- Focus not just on the average age at death, but also on the **variation in age-at-death**
- Develop of mortality projections (and projection models) that account for differences **among** and **within** socio-economic groups
- **Understand the drivers** of mortality inequalities
- **Recognise socio-economic differences when (re-)designing pension and social security programs**
- Importance of **interdisciplinary work**

References I

Chetty, Raj, Michael Stepner, Sarah Abraham, Shelby Lin, Benjamin Scuderi, Nicholas Turner, Augustin Bergeron, and David Cutler. 2016. "The Association Between Income and Life Expectancy in the United States, 2001-2014." *Clinical Review&Education Special* 315 (16): 1750–66. doi:10.1001/jama.2016.4226.

CMI. 2019. "Working Paper 115. CMI Mortality Projection Model: Interim update."

Mayhew, Les, Gillian Harper, and Andrés M. Villegas. 2018. "Inequalities matter an investigation into the impact of deprivation on demographic inequalities in adults." March. London: International Longevity Centre.