Defining Health:

Data, Discovery and the Path to Longevity



Disclosure Statement

- I have nothing to disclose

Objectives

01 Be able to define health

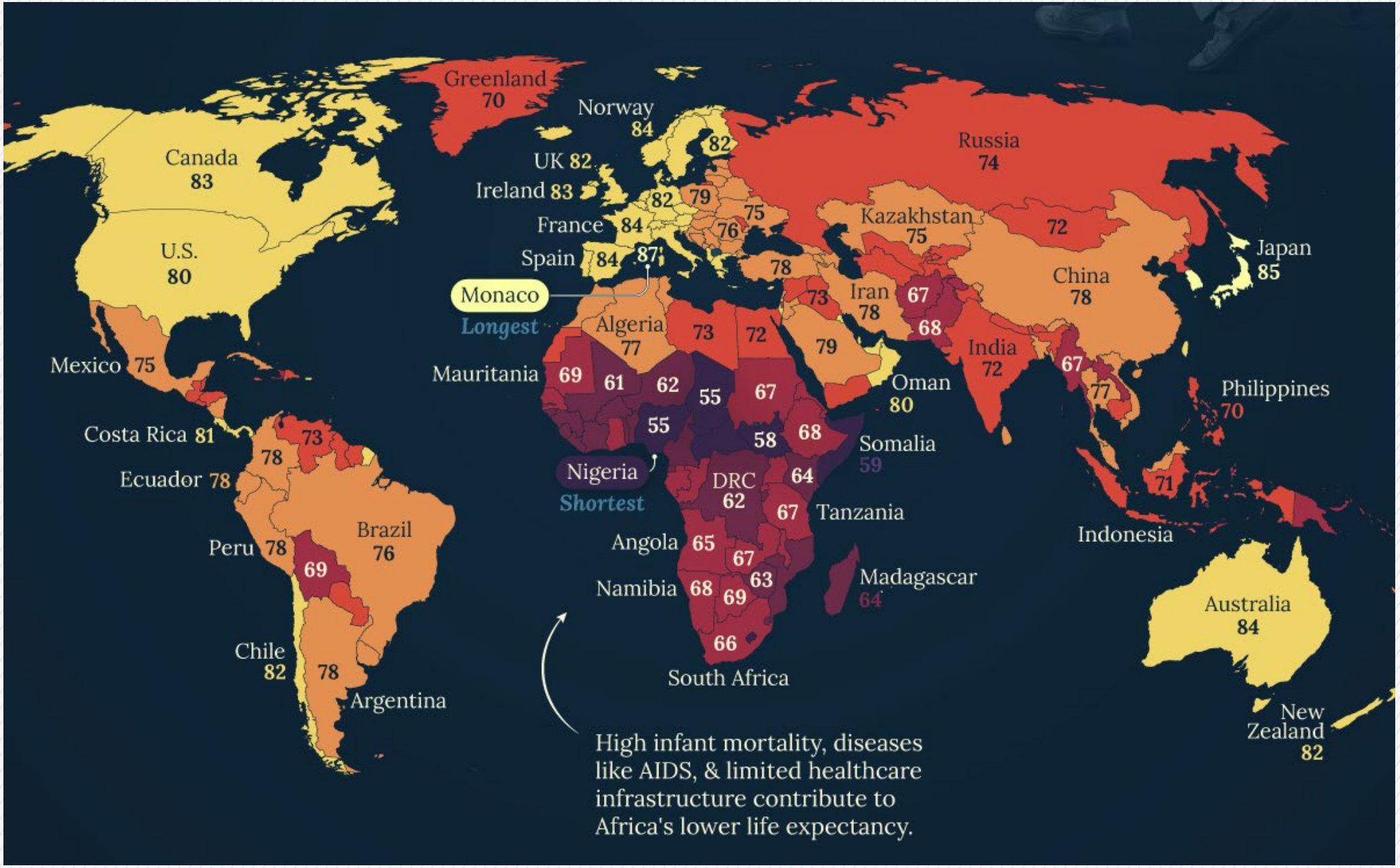
02 Describe habits and data around longevity

03 Explain differences in healthspan and lifespan

04 Understand how cutting-edge physics can apply to medicine

Practice Gap / Educational Need / Expected Outcome

- **Practice Gap** – Clinicians treat by chronological age and disease risk, rarely addressing the behavioral and psychosocial drivers of healthspan, leaving Americans with roughly a decade of life in poor health.
- **Educational Need** – Clinicians need to define health as biological age, distinguish healthspan from lifespan, and recognize the determinants that measurably shift longevity.
- **Expected Outcome** – Learners will screen for stress, adverse childhood experiences, social isolation, and purpose, and counsel patients on interventions that extend healthspan.



https://www.visualcapitalist.com/mapped-life-expectancy-by-country-in-2025/

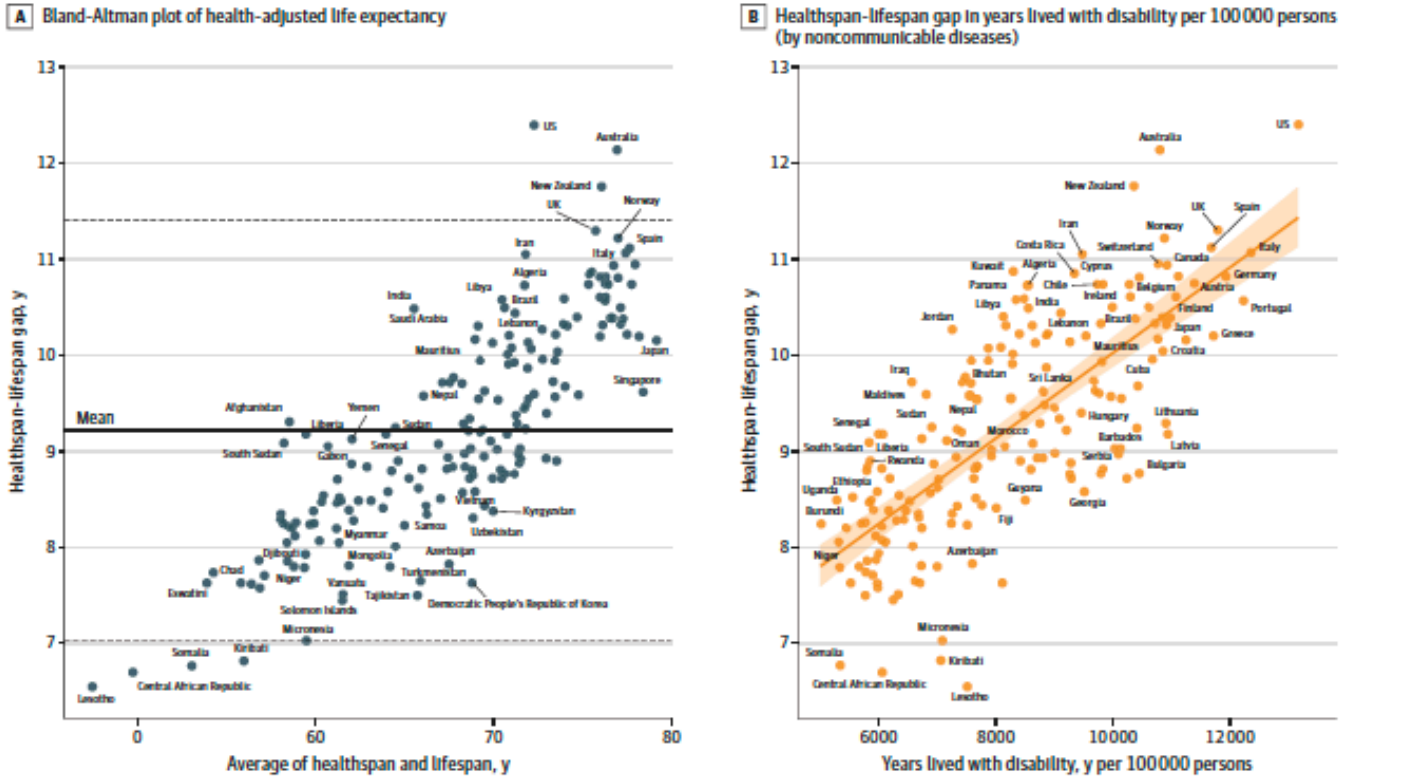
JAMA Network Open

Original Investigation | Global Health

Global Healthspan-Lifespan Gaps Among 183 World Health Organization Member States

Armin Garmany, BS; Andre Terzic, MD, PhD

Figure 3. Healthspan-Lifespan Gap Associations With Life Expectancy and Disease Burden



A, Bland-Altman plot of the health-adjusted life expectancy and life expectancy. Solid line represents the mean healthspan-lifespan gap. Dotted lines represent the 95% CI for the healthspan-lifespan gap. B, The healthspan-lifespan gap as a function of years lived with disability per 100 000 persons contributed by noncommunicable diseases. Solid line represents the line of best fit and the shaded ribbon represents the 95% CI for the regression line.

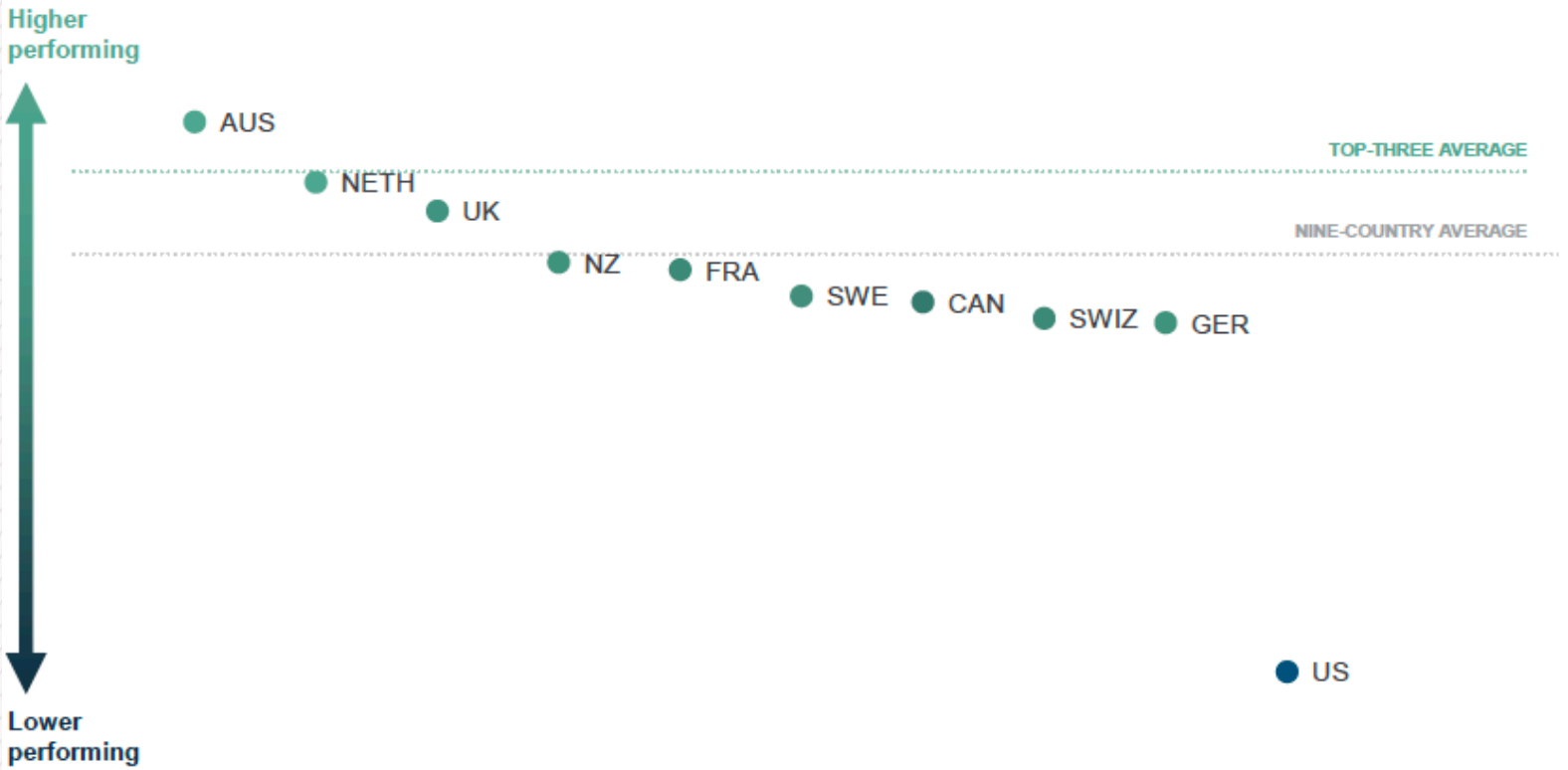
AREA OF FOCUS:

Improving Health Care Quality

Mirror, Mirror 2024: A Portrait of the Failing U.S. Health System Comparing Performance in 10 Nations



The United States lags its international peers considerably on health system performance.



Note: To normalize performance scores across countries, each score is the calculated standard deviation from a nine-country average that excludes the US. See "How We Conducted This Study" for more detail.

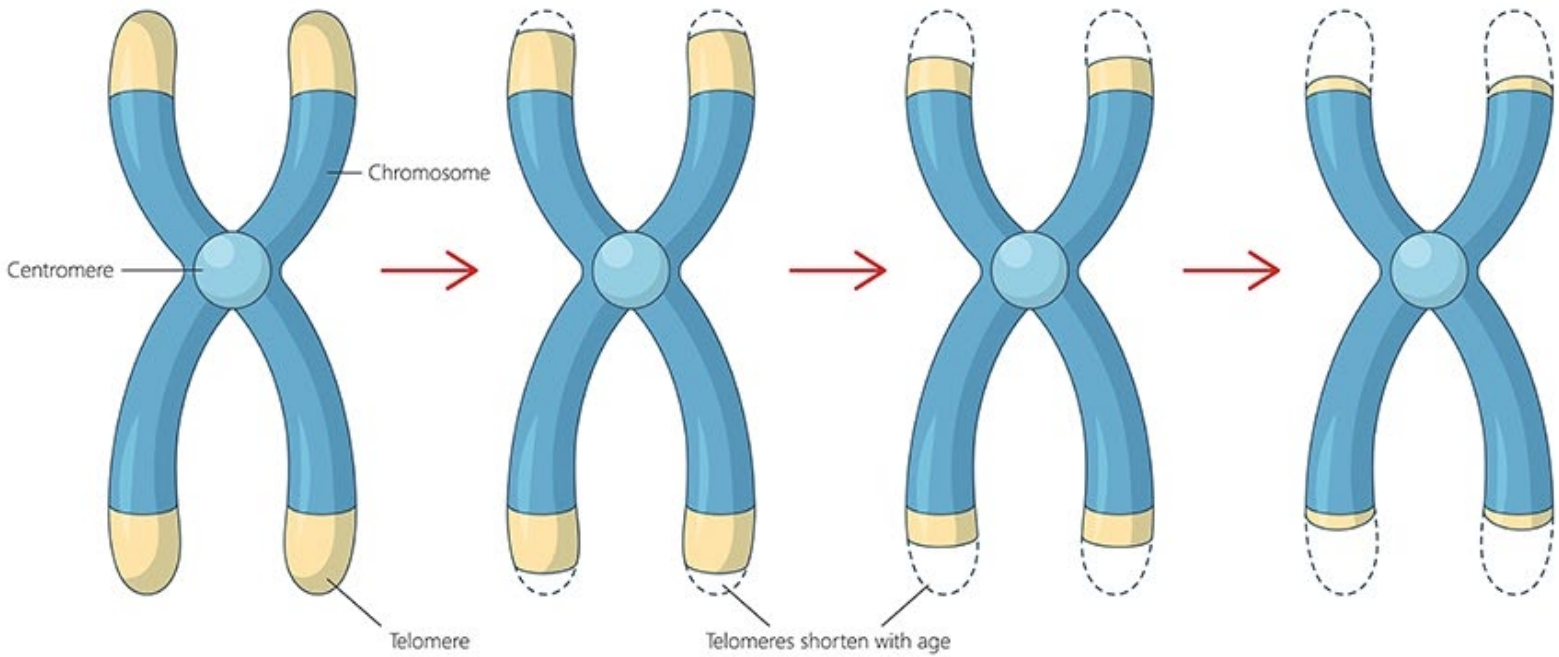
Data: Commonwealth Fund analysis.

How Do We Define Health?

Health = Biological Age Compared to Chronological Age.

How Do We Quantify Biological Age?

Telomere Shortening With Age

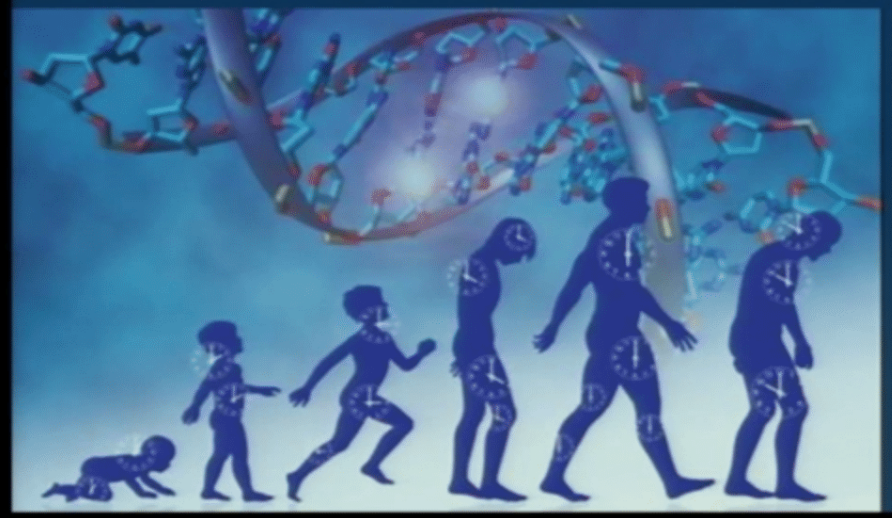


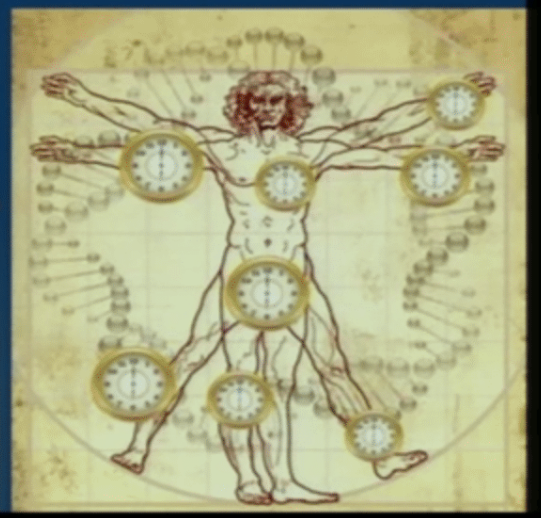
Age Reverse



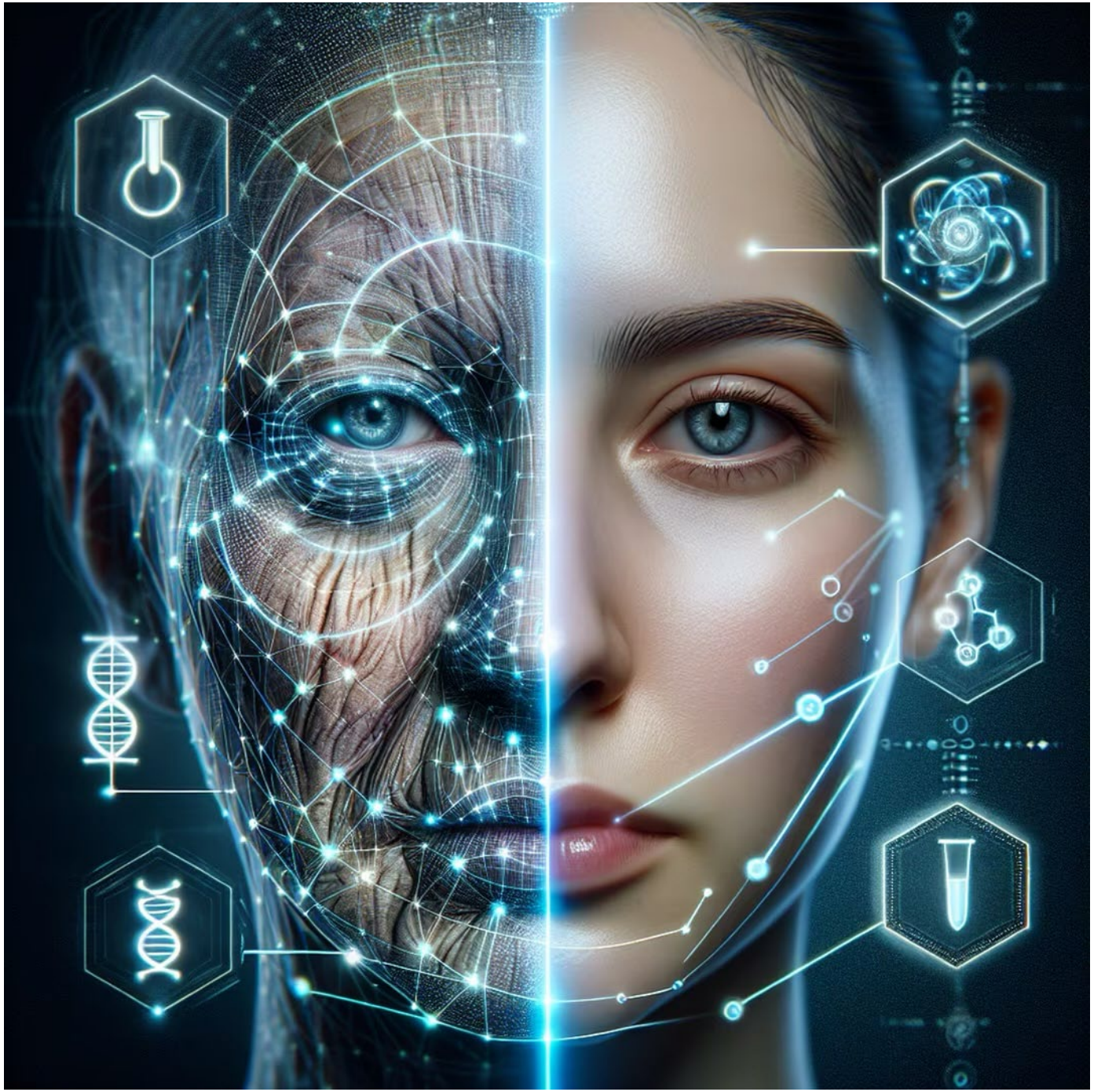
The epigenetic clock, biological age, and chronic diseases

Steve Horvath
University of California, Los Angeles





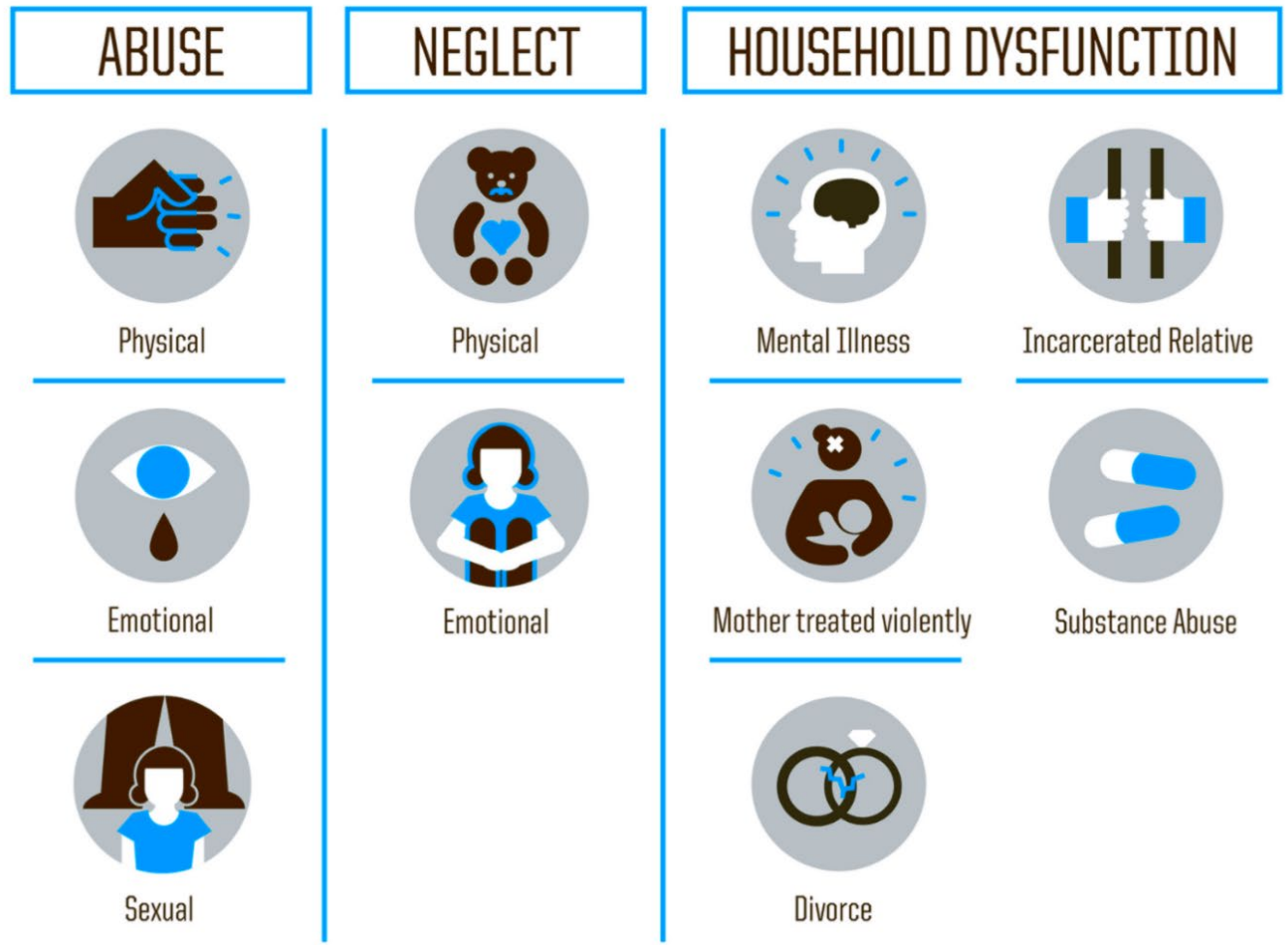
John Sabes



OPENTOOLS

Adverse Childhood Experience Survey

Three Types of ACEs



Source: Centers for Disease Control and Prevention

Credit: Robert Wood Johnson Foundation

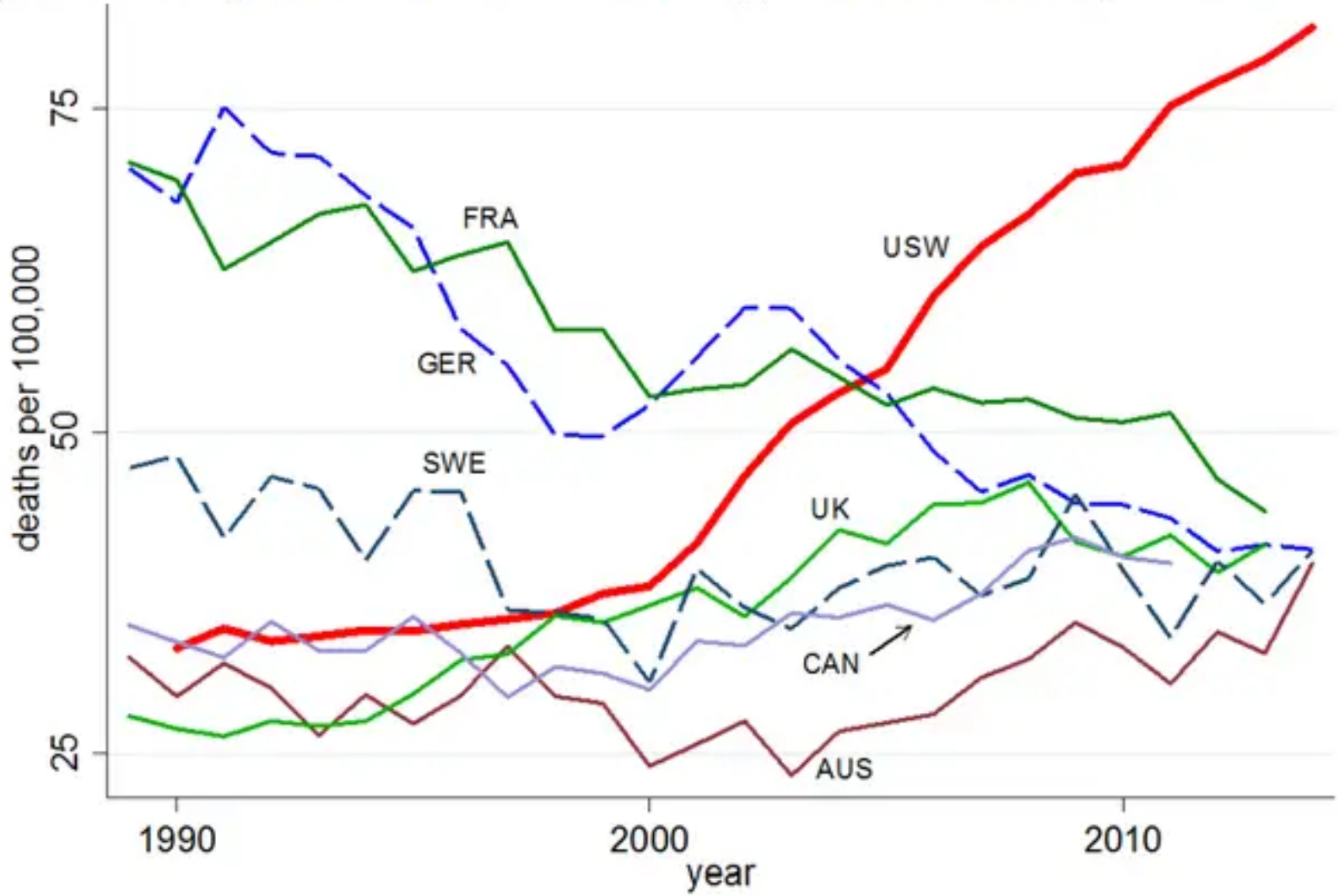
Rising morbidity and mortality in midlife among white non-Hispanic Americans in the 21st century

Anne Case[1] and Angus Deaton[1]

Woodrow Wilson School of Public and International Affairs and Department of Economics, Princeton University, Princeton, NJ 08544

Contributed by Angus Deaton, September 17, 2015 (sent for review August 22, 2015; reviewed by David Cutler, Jon Skinner, and David Weir)

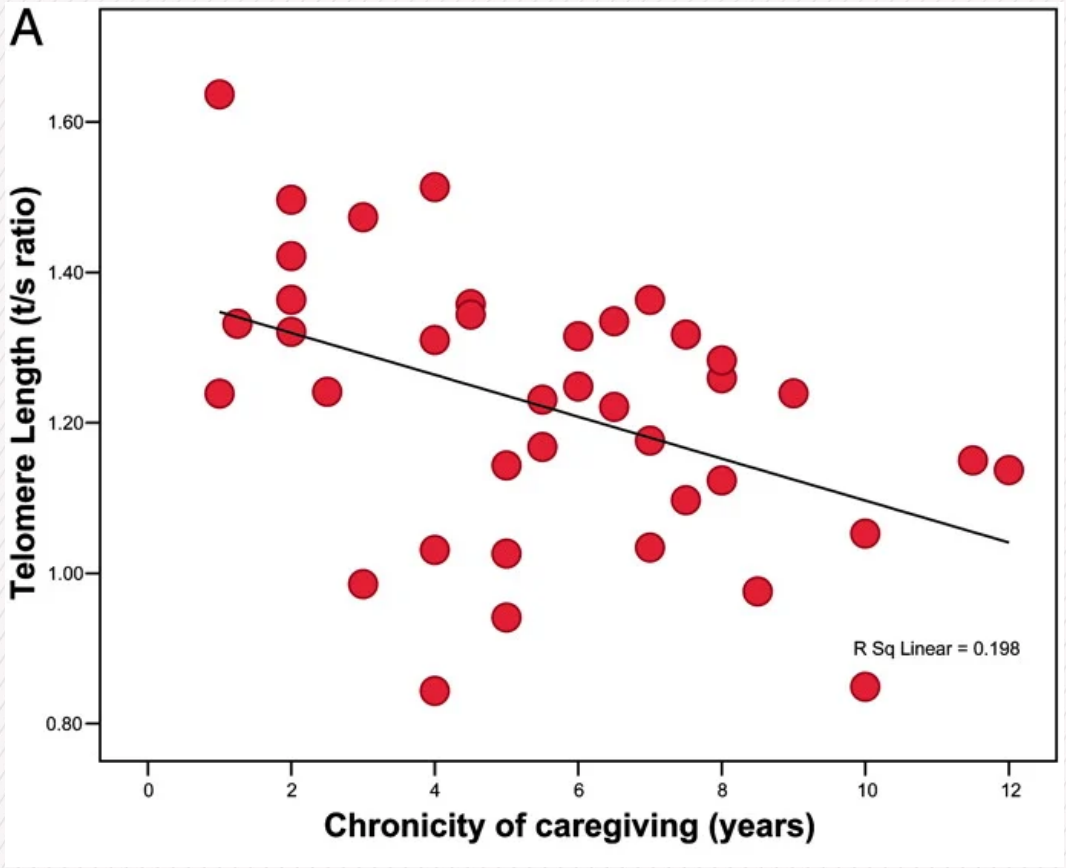
Figure 1.5 Drug, alcohol and suicide mortality, men and women ages 50-54

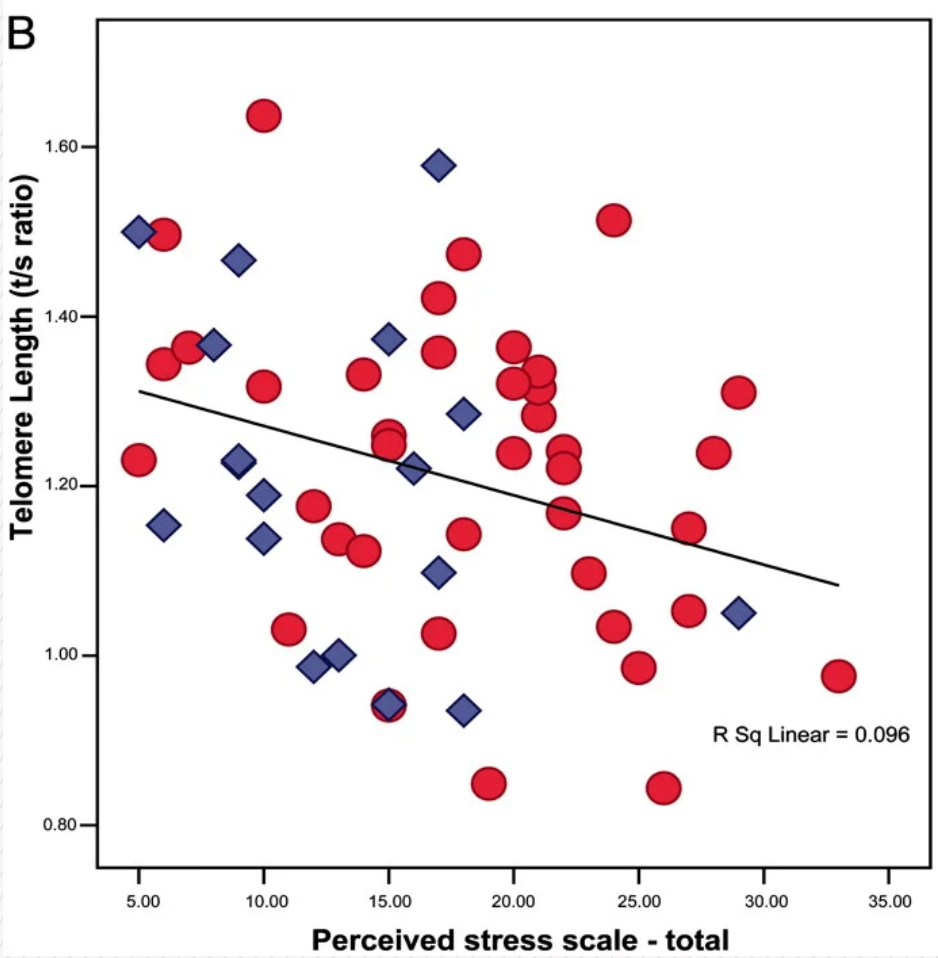


Accelerated telomere shortening in response to life stress

Elissa S. Epel*†, Elizabeth H. Blackburn‡, Jue Lin‡, Firdaus S. Dhabhar§, Nancy E. Adler*, Jason D. Morrow¶, and Richard M. Cawthon‖

PNAS December 1, 2004: 101 (49) 17312-17315





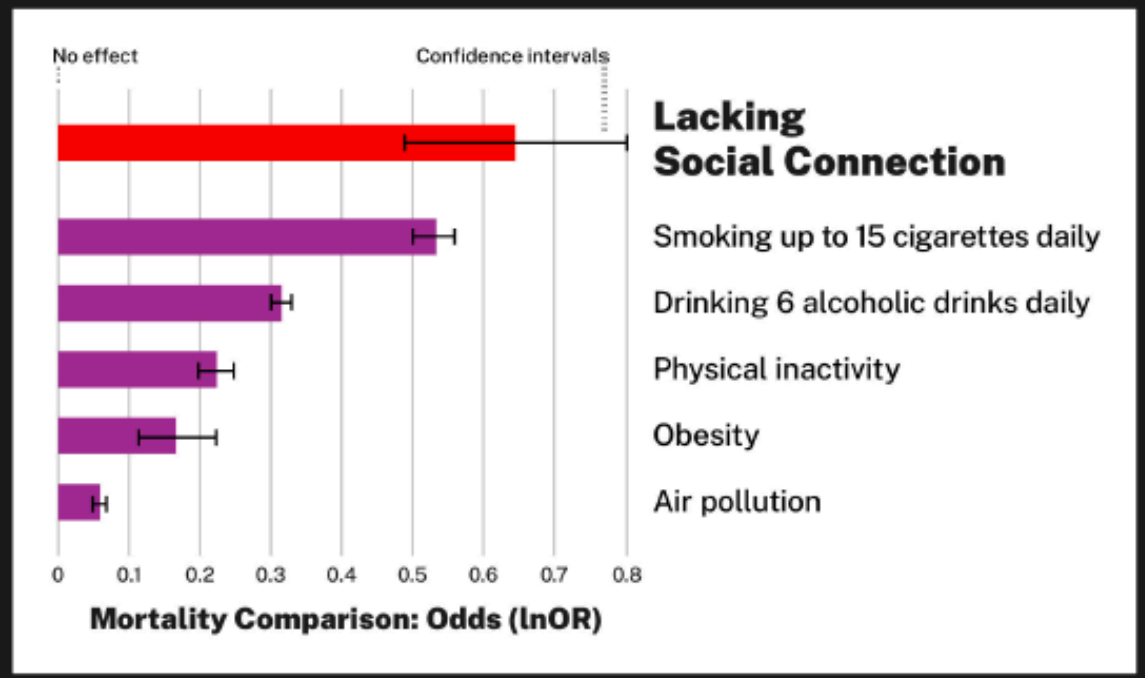
PNAS December 1, 2004: 101 (49) 17312-17315

Our Epidemic of Loneliness and Isolation 2023

The U.S. Surgeon General's Advisory on the Healing Effects of Social Connection and Community



Lacking social connection is as dangerous as smoking up to 15 cigarettes a day.



Comparison groups: Complex measures of social integration: high v. low; not smoking v. smoking < 15 cigarettes daily; alcohol abstinence v. drinking > 6 alcoholic drinks daily; physical activity v. inactivity; low BMI v. high BMI; low air pollution v. high air pollution.

Source: Holt-Lunstad J, Robles TF, Sbarra DA. Advancing Social Connection as a Public Health Priority in the United States. *American Psychology*. 2017;72(6):517-530. doi:10.1037/amp0000103. This graph is a visual approximation.

Office *of the* U.S. Surgeon General

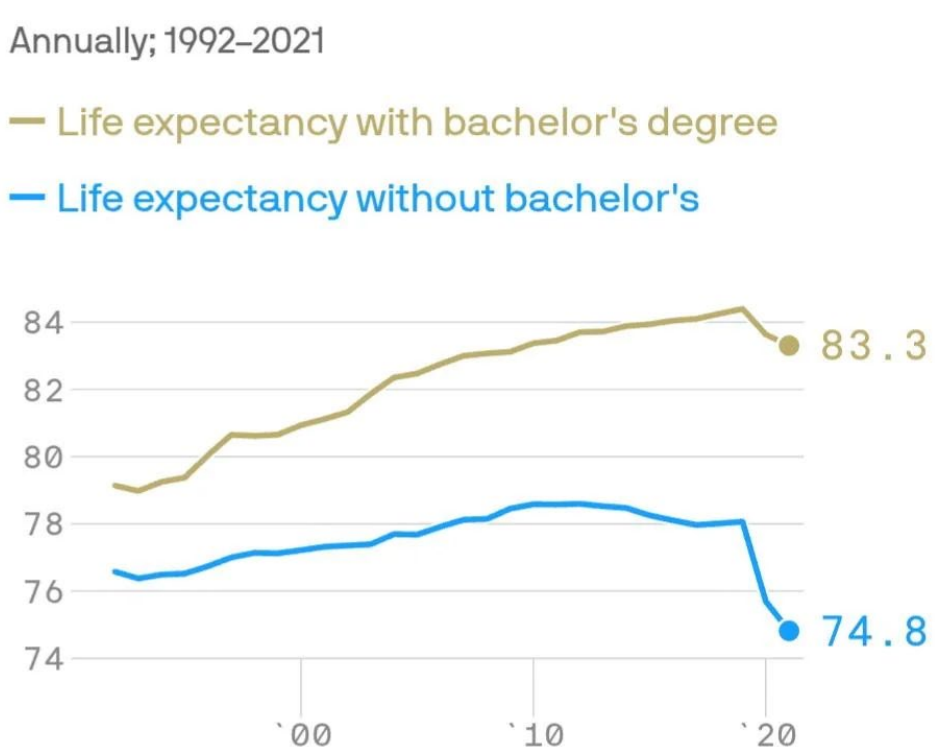
ANNE CASE
Princeton University

ANGUS DEATON
Princeton University

Accounting for the Widening Mortality Gap between American Adults with and without a BA

Life expectancy of American adults by education level

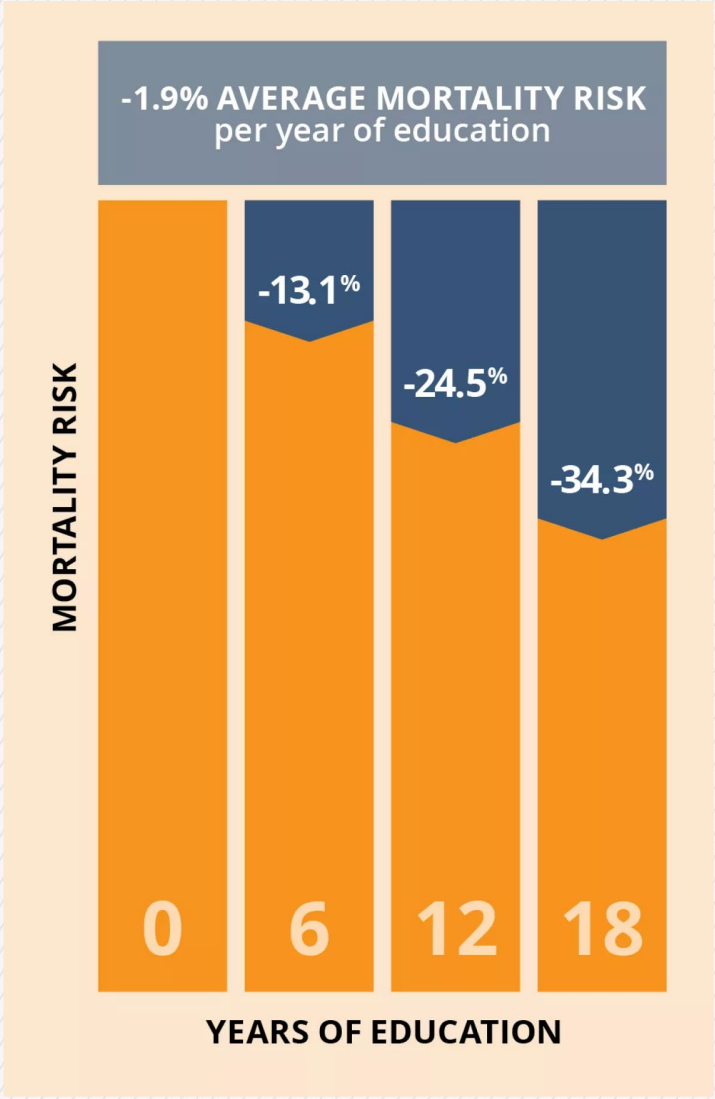
Annually; 1992–2021



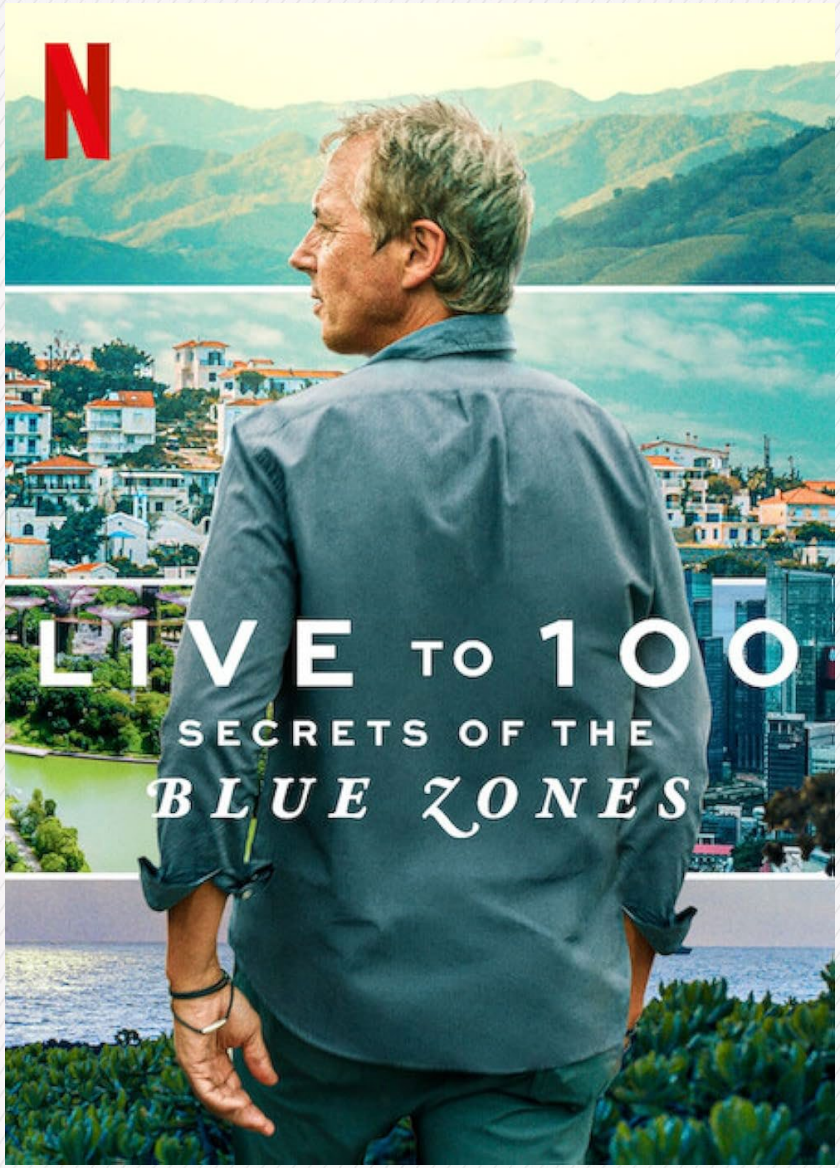
Data: Brookings Institute; Anne Case and Angus Deaton, Princeton University; Chart: Axios Visuals

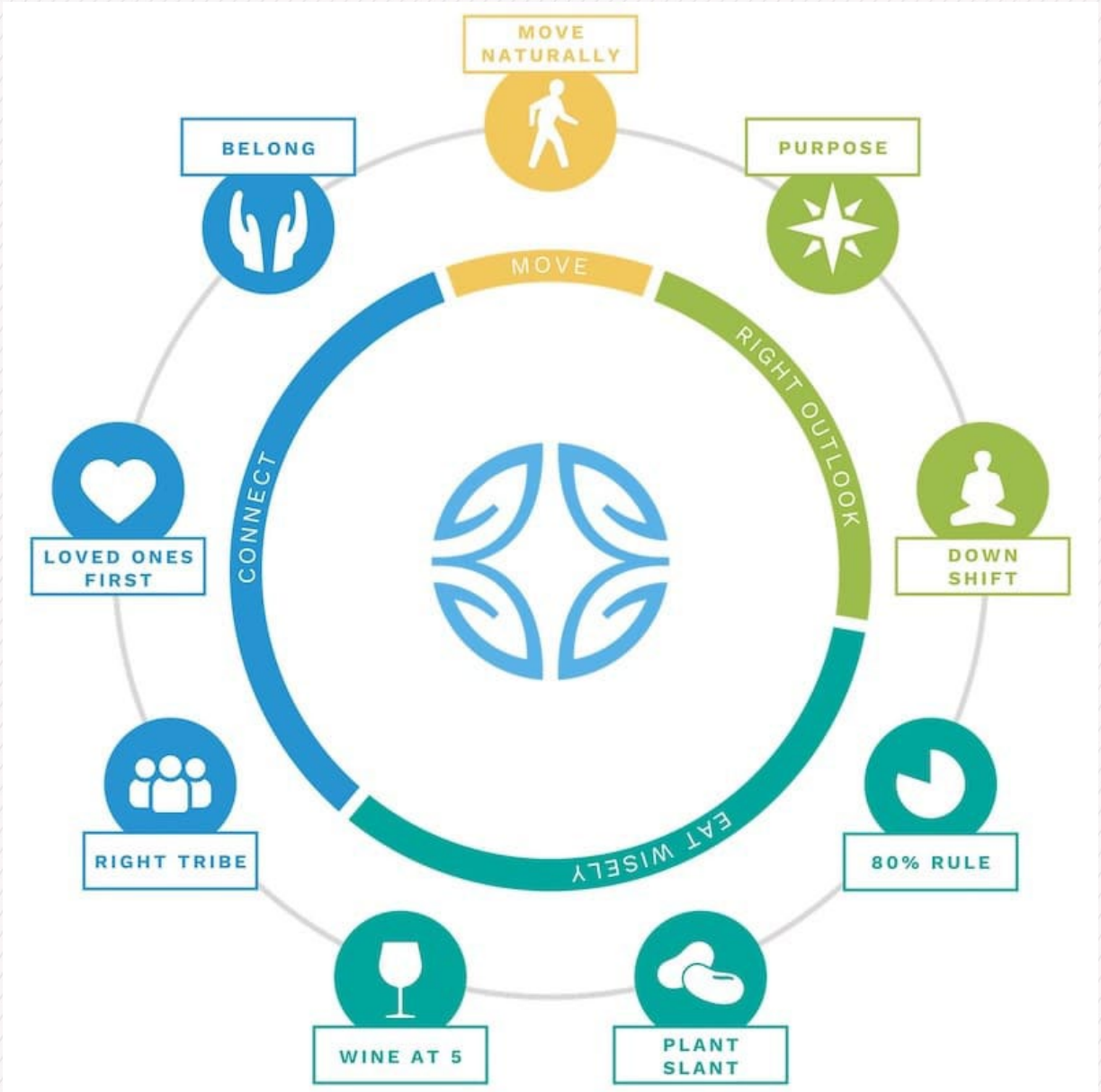
The longevity-boosting power of education

Published January 23, 2024



IHME


LIVE TO 100
SECRETS OF THE
BLUE ZONES


MOVE NATURALLY
PURPOSE
DOWN SHIFT
80% RULE
PLANT SLANT
WINE AT 5
RIGHT TRIBE
LOVED ONES FIRST
BELONG
MOVE
RIGHT OUTLOOK
EAT WISELY
CONNECT



American Heart Association

"This is an important—and deeply fascinating—book."
—MALCOLM GLADWELL

The Longevity Project



Surprising Discoveries for Health and Long Life from the Landmark EIGHT-DECADE STUDY

BOOKS FOR A BETTER LIFE
AWARD WINNER
National MS Society • New York City – Southern New York Chapter

HOWARD S. FRIEDMAN, Ph.D. and
LESLIE R. MARTIN, Ph.D.



Stanford Center on Longevity


EnchantedWishes
生き甲斐
ikigai
"A reason for being;" the thing that gets you up in the morning. Having a sense of purpose in life and a feeling of well-being.

Yzixulet

ABUNDANCE VS. SCARCITY MINDSET

ASPECT	SCARCITY MINDSET	ABUNDANCE MINDSET
RESOURCES	Feels limited, not enough to go around.	Believes in plenty for everyone.
EMOTIONAL STATE	Worry, fear, and comparison.	Gratitude and optimism.
BEHAVIOR	Seeks validation, clings to lack.	Focuses on growth, embraces opportunities.
CHALLENGES	Feels overwhelmed, avoids risks.	Sees challenges as opportunities, stays positive.
OVERALL APPROACH	Operates from fear and scarcity.	Operates from abundance and possibility.

DearMedia

PNAS

RESEARCH ARTICLE | ANTHROPOLOGY

OPEN ACCESS

Energy expenditure and obesity across the economic spectrum

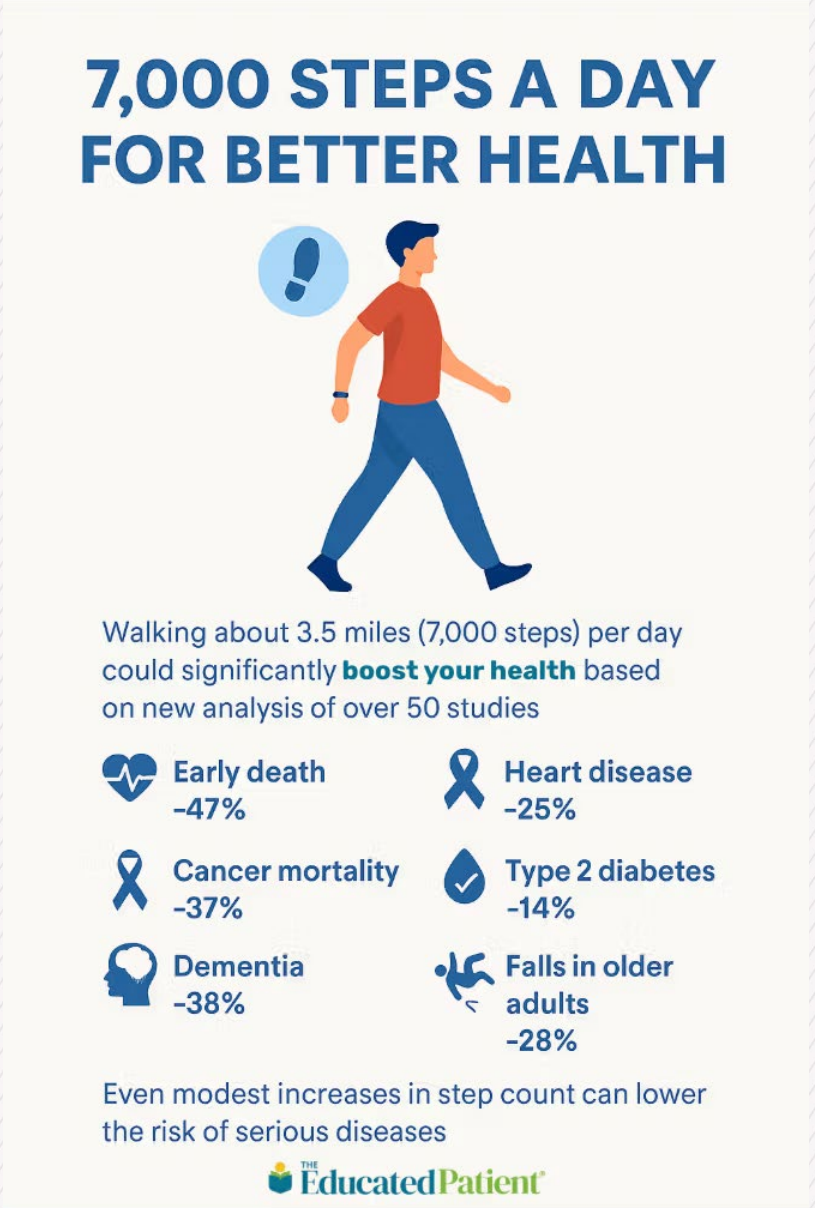
Amanda McGrosky[a,b,1], Amy Luke[c,1], Leonore Arab[d], Kweku Bedu-Addo[e], Alberto G. Bonomi[f], Pascal Bovet[g], Soren Brage[h], Maciej S. Buchowski[i], Nancy Butte[j], Stefan G. Camps[k], Regina Casper[l], Daniel K. Cummings[m], Sai Krupa Das[n], Sanjoy Deb[o], Lara R. Dugas[c,p], Ulf Ekelund[q], Terrence Forrester[r], Barry W. Fudge[s], Melanie Gillingham[t], Annelies H. Goris[u], Michael Gurven[v], Catherine Hambly[w], Annemiek Joosen[x], Peter T. Katzmarzyk[y], Kitty P. Kempen[x], William E. Kraus[z], Wantanee Kriengsinyos[aa], Rebecca Kuriyan[bb], Robert F. Kushner[cc], Estelle V. Lambert[dd], Christel L. Larsson[ee], William R. Leonard[cc], Nader Lessan[ff,gg], Marie Löf[hh], Corby K. Martin[y], Anine C. Medin[ii,jj], Marian L. Neuhouser[kk], Kirsi H. Pietilainen[ll], Guy Plasqui[mm], Ross L. Prentice[kk], Susan B. Racette[nn], David A. Raichlen[oo], Eric Ravussin[y], Leanne Redman[y], Rebecca M. Reynolds[pp], Eric B. Rimm[qq], Susan Roberts[rr], Asher Y. Rosinger[ss,tt], Mary H. Samuels[uu], Srishti Sinha[bb], J. Josh Snodgrass[vv], Eric Stice[l], Ricardo Uauy[ww], Samuel S. Urlacher[xx], Jeanine A. Verbunt[x], Bruce Wolfe[yy], Brian Wood[zz,aaa], Xueying Zhang[bbb], Alexia J. Murphy-Alford[ccc], Cornelia J. Loechl[ccc], Jennifer Rood[y,1], Hiroyuki Sagayama[ddd,1], Dale A. Schoeller[eee], Klaas R. Westerterp[x,1], William W. Wong[j,1], Yosuke Yamada[fff,ggg,1], John R. Speakman[w,bbb,1], Herman Pontzer[a,hhh,1], and The IAEA DLW Database Consortium[2]

Affiliations are included on p. 7.

Edited by Daniel Nettle, PSL University, Paris, France; received October 10, 2024; accepted March 31, 2025 by Editorial Board Member James F. O'Connell

Daily steps and health outcomes in adults: a systematic review and dose-response meta-analysis

Ding Ding, Binh Nguyen, Tracy Nau, Mengyun Luo, Borja del Pozo Cruz, Paddy C Dempsey, Zachary Munn, Barbara J Jefferis, Cathie Sherrington, Elizabeth A Calleja, Kar Hau Chong, Rochelle Davis, Monique E Francois, Anne Tiedemann, Stuart J H Biddle, Anthony Okely, Adrian Bauman, Ulf Ekelund, Philip Clare*, Katherine Owen*



The Educated Patient

Are There New Clues to How to Live our Life Longer and Better?

What I Learned from Quantum Physics and Eastern Philosophy

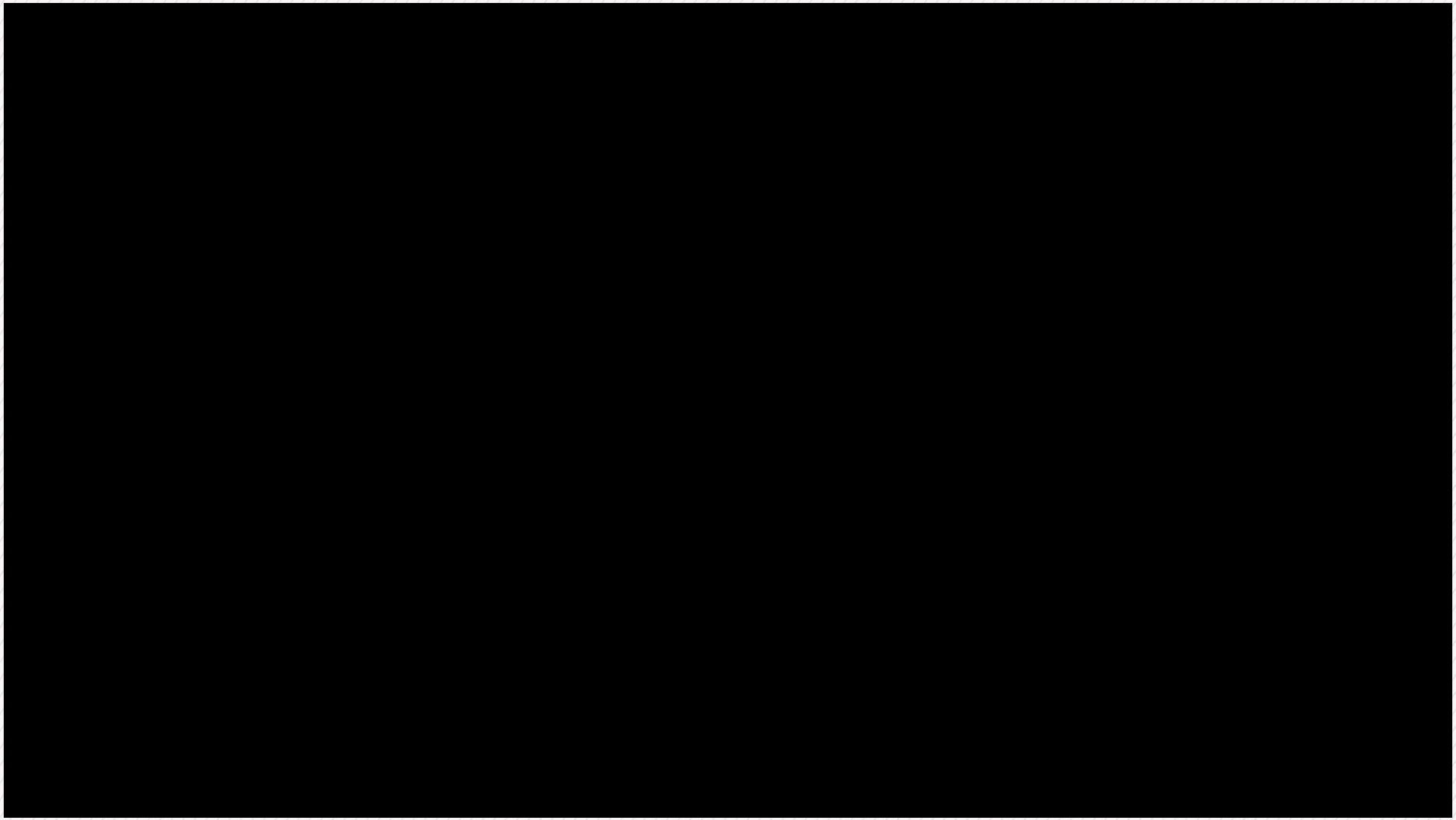
- Quantum Physics Occurs Beyond our Senses
- Quantum Physics is a Study of Probability, Not Precision
- Energy is Mass
- We Live in a Participatory Universe
- Everything is Connected as One
- Nothing We Perceive is Seen as It Is
- Philosophers, Spiritual Leaders and Poets Knew These Concepts Long Ago

“I regard consciousness as fundamental. I regard matter as derivative from consciousness”

Max Planck

Live with Gratitude

The Power of Gratitude and Presence



YOU ARE NOT A DROP IN THE OCEAN. YOU ARE THE ENTIRE OCEAN IN A DROP.

Jalal al-Din Rumi


Let's Go!