How should we teach epidemiology in the 21st century?

Katherine Keyes

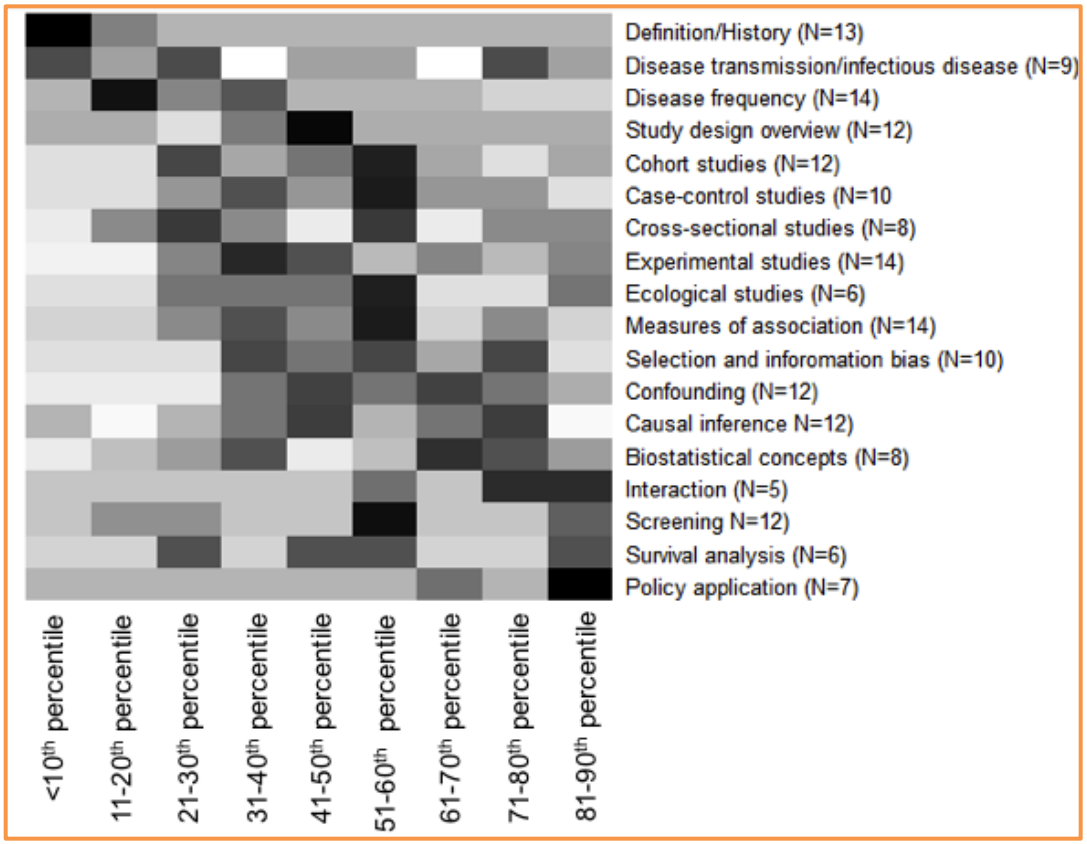
Columbia University

Epidemiology Matters

A new introduction to methodological foundations

Katherine M. Keyes
Sandro Galea

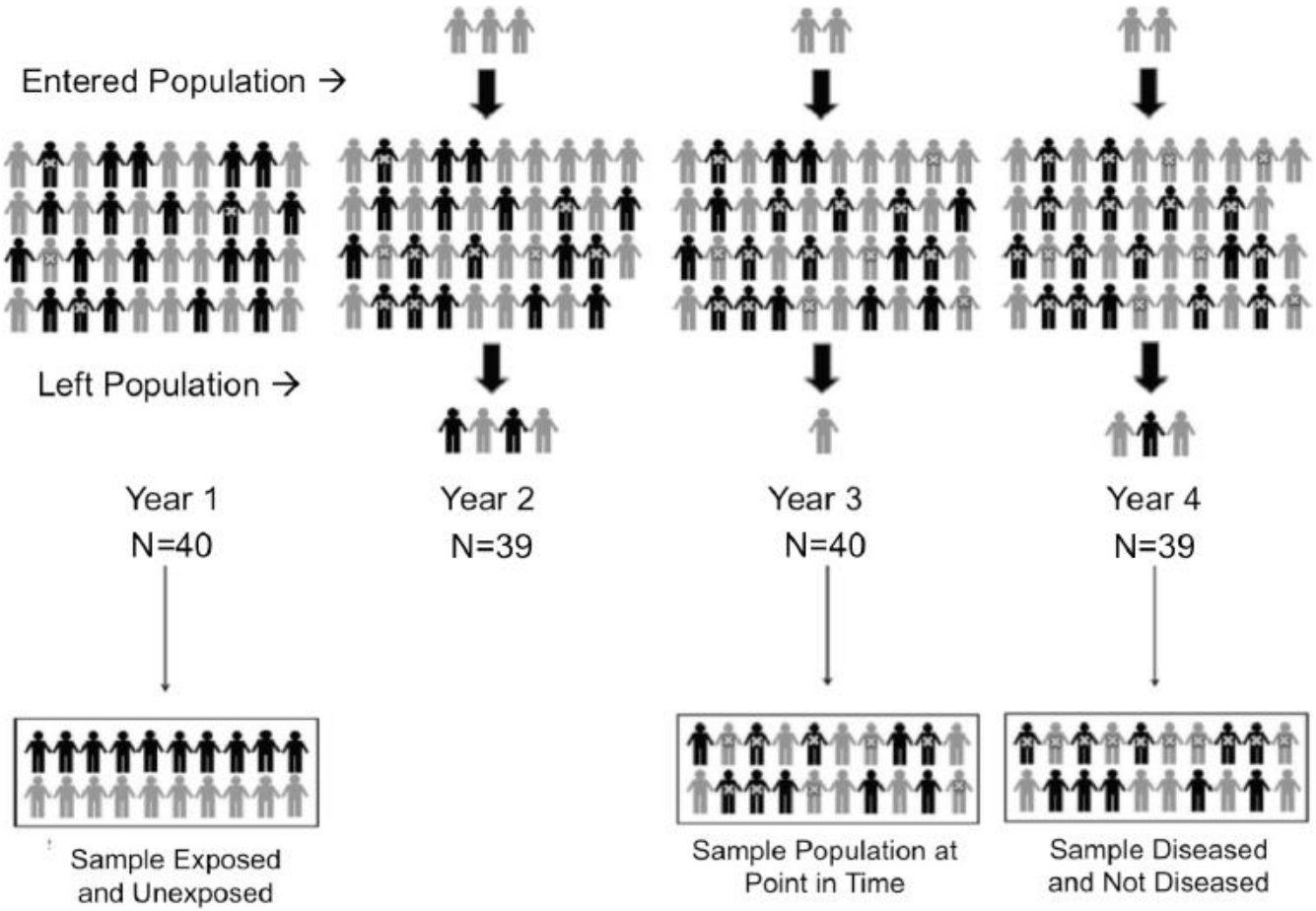
OXFORD



* Textbooks included: Aschengrau & Seage, Bhopal, Bonita et al., Carneiro & Howard, Carr et al., Friis, Gertman, Gordis, Kestenbaum, Merrill, Rothman, Saracci, Webb, Wassertheil-Smoller.

Keyes KM, Galea S. (2014). Current practices in teaching introductory epidemiology: how we got here, where to go. American Journal of Epidemiology, 180(7): 661-668. PMID: 25190677.

Figure 5. Taking different samples from a population



Keyes KM, Galea S. CITE BOOK HERE

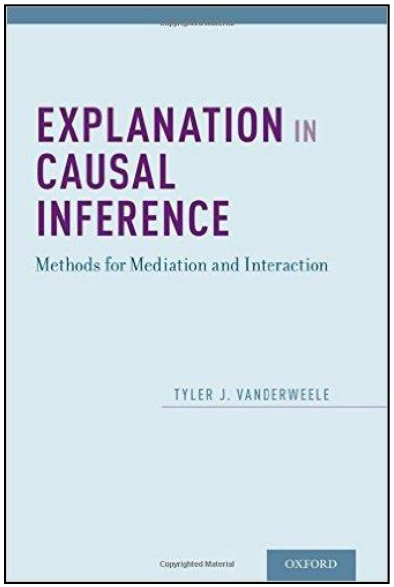
What is epidemiology?

Several views (not necessarily opposing):

Provides a framework and tools to interpret estimates from studies as causal

Provides policy makers with evidence-based recommendations

Generates scientific knowledge about the distribution and determinants of disease in populations



Mathematical Modelling, Vol. 7, pp. 1393–1512, 1986
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A NEW APPROACH TO CAUSAL INFERENCE IN MORTALITY STUDIES WITH A SUSTAINED EXPOSURE PERIOD—APPLICATION TO CONTROL OF THE HEALTHY WORKER SURVIVOR EFFECT

JAMES ROBINS

Harvard School of Public Health
665 Huntington Avenue
Boston, MA 02115

Practice of Epidemiology

The Control Outcome Calibration Approach for Causal Inference With Unobserved Confounding

Eric Tchetgen Tchetgen*

* Correspondence to Dr. Eric Tchetgen Tchetgen, Department of Biostatistics, Harvard University, 677 Huntington Avenue, Kresge, Room 822, Boston, MA 02115 (e-mail: etchetge@hsph.harvard.edu).

Neuropsychol Rev (2008) 18:194–213
DOI 10.1007/s11065-008-9066-x

Methodological Challenges in Causal Research on Racial and Ethnic Patterns of Cognitive Trajectories: Measurement, Selection, and Bias

M. Maria Glymour · Jennifer Weuve · Jarvis T. Chen

The Consistency Statement in Causal Inference

A Definition or an Assumption?

Stephen R. Cole[a] and Constantine E. Frangakis[b]

Estimating causal effects from epidemiological data

Miguel A Hernán, James M Robins

J Epidemiol Community Health 2006;**60**:578–586. doi: 10.1136/jech.2004.029496

According to this view,

Exposures should be conceptualized as the potential RCT or intervention that could be done to change them.

”Causal questions”, then, are those in which we can be very specific about *how* the exposure could be changed.

Does obesity shorten life? The importance of well-defined interventions to answer causal questions

MA Hernán[1,2] and SL Taubman[1,3]

International Journal of Obesity (2008) 32, S8–S14

0307-0565/08 $30.00
www.nature.com/ijo

[1]Department of Epidemiology, Harvard School of Public Health, Boston, MA, USA; [2]Harvard-MIT Division of Health Sciences and Technology, Boston, MA, USA and [3]Center for Clinical Epidemiology and Biostatistics, University of Pennsylvania School of Medicine, Philadelphia, PA, USA

"Causal effects cannot be defined, much less computed, in the absence of a well-defined intervention."

"**…if the goal is to inform policy, it may be better to focus on modifiable lifestyle behaviors than on obesity itself, regardless of whether we use observational studies or randomized trials.** We have discussed above that the lack of randomization in observational studies makes it necessary to assume that no unmeasured confounding exists, a strong uncheckable assumption. However, if one is willing to believe that the assumption of no unmeasured confounding is approximately true, observational data can be used to mimic randomized experiments in which subjects or populations are 'assigned' to a well-defined intervention, followed for a certain time, and the outcome distribution compared among intervention groups. By considering observational studies in this way, **we avoid tackling questions that cannot be logically asked in randomized experiments.**"

Social Science & Medicine xxx (2015) 1–4

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Is the "well-defined intervention assumption" politically conservative?

Sharon Schwartz [a, *], Seth J. Prins [a], Ulka B. Campbell [b], Nicolle M. Gatto [b]

[a] Department of Epidemiology, Columbia University, Mailman School of Public Health, USA
[b] Department of Epidemiology, Columbia University, Mailman School of Public Health, Epidemiology, Worldwide Safety and Regulatory, Pfizer Inc., USA

"…as the well-defined intervention requirement gains traction, it should not relegate all other types of causal questions to the ocean depths of "fishy causal concepts" or to surveillance or work that is of no use to anyone. There is utility in work within the policy space but work outside the policy space is critical."

International Journal of Epidemiology, 2016, 1–11
doi: 10.1093/ije/dyv341
Original article

Original article

Causality and causal inference in epidemiology: the need for a pluralistic approach

Jan P Vandenbroucke,[1,*,†] Alex Broadbent[2,†] and Neil Pearce[3]

"The scientific process is much more messy, interesting and productive than the [Restricted Potential Outcomes] approach."

Viewpoint

Should the mission of epidemiology include the eradication of poverty?

Kenneth J Rothman, Hans-Olov Adami, Dimitrios Trichopoulos

Lancet 1998; **352:** 810–13

"Physicists seem to have escaped the old criticism that their work is impractical. Perhaps the criticism was blunted by technological innovations that rest on physical theory. Nevertheless, even astrophysicists, whose work seldom induces engineering breakthroughs, **can now pursue knowledge for its own sake without fear of being badgered about the practical relevance of their work**. What physicists have gained, however, epidemiologists seem to have lost."

Published by Oxford University Press on behalf of the International Epidemiological Association

International Journal of Epidemiology 2013;**42**:1012–1014
doi:10.1093/ije/dys223

POINT COUNTERPOINT

Why representativeness should be avoided

Kenneth J Rothman,[1,2] John EJ Gallacher[3] and Elizabeth E Hatch[1]

[1]Department of Epidemiology, Boston University School of Public Health, Boston, MA, USA, [2]RTI Health Solutions, RTI International, Research Triangle Park, NC, USA and [3]Institute of Primary Care and Public Health, Cardiff University, Cardiff, UK

Accepted 21 November 2012

"…statistical representativeness leads to particular statements about the world, not general statements about nature."

"…we draw a line between the scientific goal of understanding a phenomenon and the practical goal of applying that knowledge to specific populations."

Commentary

An Argument for a Consequentialist Epidemiology

Sandro Galea*

* Correspondence to Dr. Sandro Galea, Department of Epidemiology, Mailman School of Public Health, Columbia University, 722 W. 168th Street, Room 1508, New York, NY 10032-3727 (e-mail: sgalea@columbia.edu).

Initially submitted March 10, 2013; accepted for publication April 17, 2013.

"…academic epidemiology now spends most of its time concerned with identifying the causes and distributions of disease in human populations and far less of its time and imagination asking how we might improve population health, what might happen if a particular approach were taken to try to do so, where and when it may be appropriate to attempt inflections to the course of the health of populations, and whether our efforts to elucidate particular causes is usefully guiding our way to population health improvement."

Why does epidemiology matter?

Several views (not necessarily opposing):

Provides a framework and tools to interpret estimates from studies as causal

Provides policy makers with evidence-based recommendations

Generates scientific knowledge about the distribution and determinants of disease in populations

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

| PNAS | December 8, 2015 | vol. 112 | no. 49

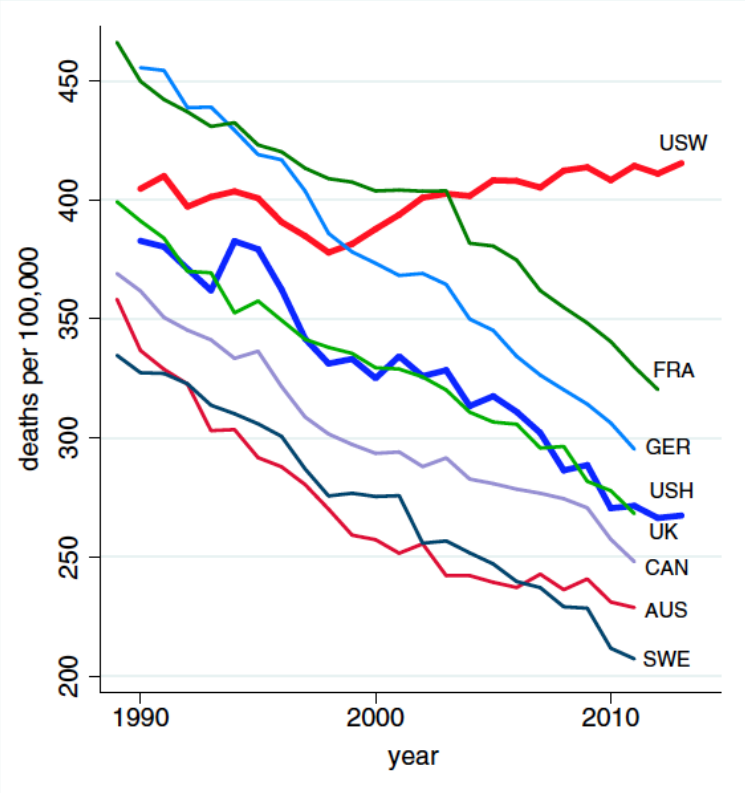


Fig. 1. All-cause mortality, ages 45–54 for US White non-Hispanics (USW), US Hispanics (USH), and six comparison countries: France (FRA), Germany (GER), the United Kingdom (UK), Canada (CAN), Australia (AUS), and Sweden (SWE).

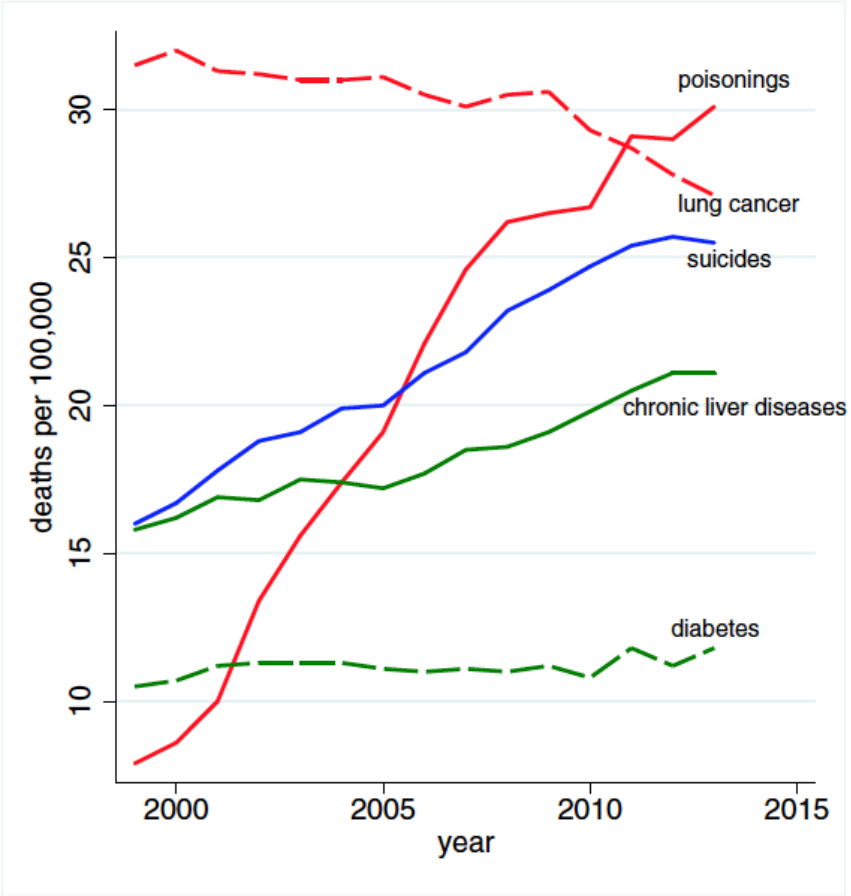


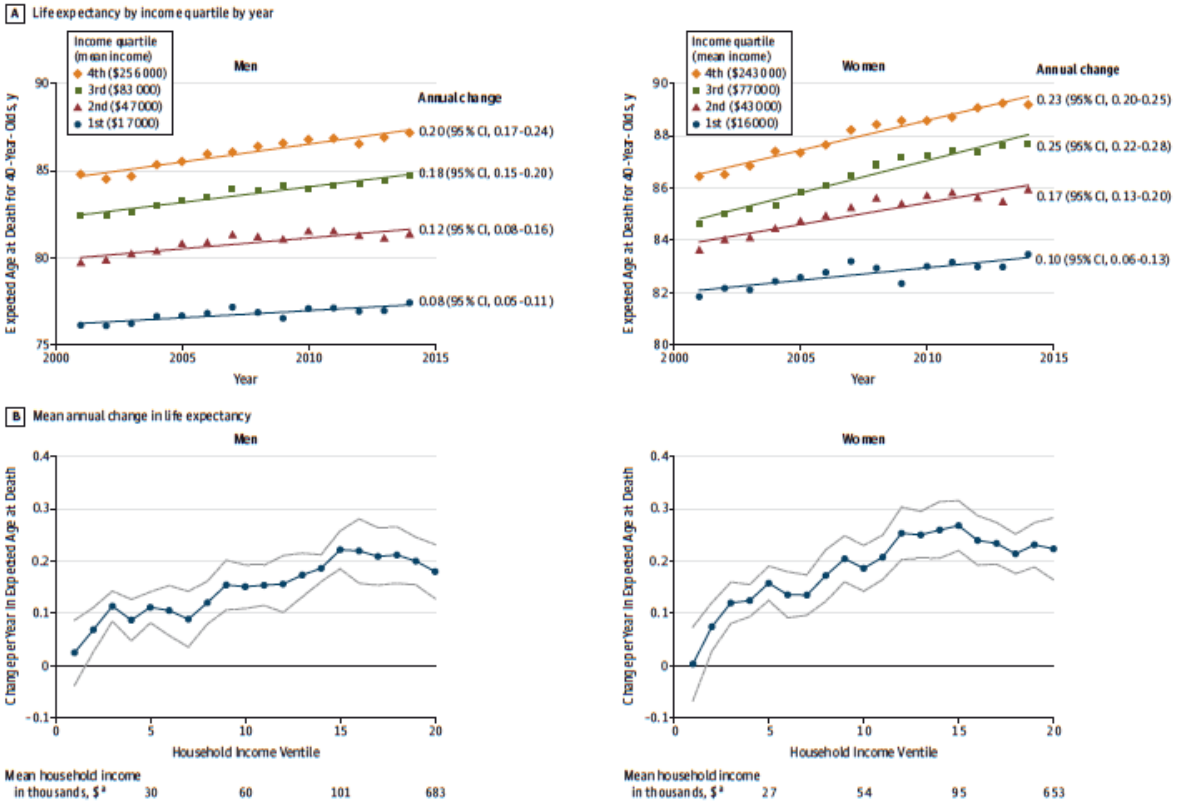
Fig. 2. Mortality by cause, white non-Hispanics ages 45–54.

The Association Between Income and Life Expectancy in the United States, 2001-2014

Raj Chetty, PhD; Michael Stepner, BA; Sarah Abraham, BA; Shelby Lin, MPhil; Benjamin Scuderi, BA; Nicholas Turner, PhD; Augustin Bergeron, MA; David Cutler, PhD

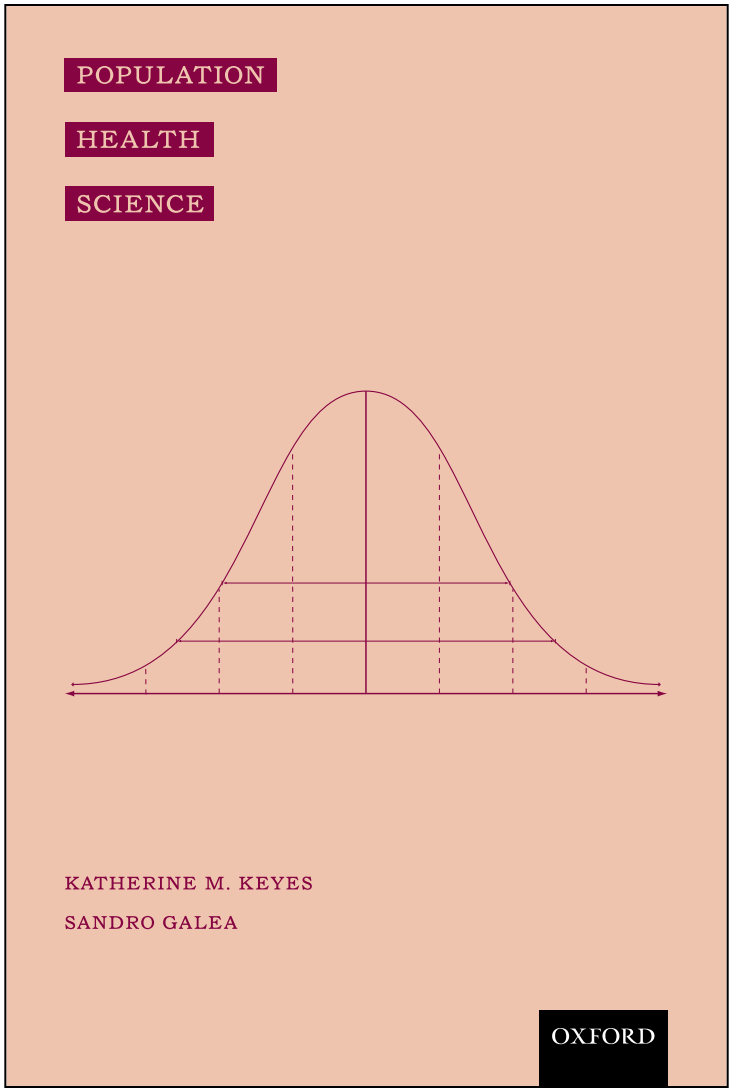
JAMA. 2016;315(16):1750-1766. doi:10.1001/jama.2016.4226
Published online April 10, 2016.

Figure 3. Changes in Race- and Ethnicity-Adjusted Life Expectancy by Income Group, 2001-2014



Scatter points in the A panels show the race- and ethnicity-adjusted life expectancy estimates by year and household income quartile. Solid lines represent best fit lines estimated using ordinary least-squares regression. The B panels plot the slopes from analogous regressions estimated separately by income ventile (5 percentile point bins). Dashed lines show 95% confidence intervals.

[a] Averaged across years and ages.



POPUL AT ION HEALTH S C I ENCE is the study of the conditions that shape
distributions of health within and across populations, and of the mechanisms
through which these conditions manifest in the health of individuals.

Foundational Principles of Population Health Science

1. Population health manifests as a continuum.
2. The causes of differences in health across populations are not necessarily an aggregate of the causes of differences in health within populations.
3. Large benefits to population health may not improve the lives of all individuals.
4. The causes of population health are multilevel, accumulate throughout the life course, and are embedded in dynamic interpersonal relationships.
5. Small changes in ubiquitous causes may result in more substantial change in the health of populations than larger changes in rarer causes.
6. The magnitude of an effect of exposure on disease is dependent on the prevalence of the factors that interact with that exposure.
7. Prevention of disease often yields a greater return on investment than curing disease after it has started.
8. Efforts to improve overall population health may be a disadvantage to some groups; whether equity or efficiency is preferable is a matter of values.
9. We can predict health in populations with much more certainty than we can predict health in individuals.

Thank you!

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kmk2104@columbia.edu