# The social and economic determinants of environmental health

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BOSTON UNIVERSITY

1. The centrality of environmental health in coming decades


“The era of global boiling has arrived”

https://news.yahoo.com/era-global-boiling-begun-un-193211086.html

The New York Times

Extreme Heat | U.S. Heat Tracker | Global Heat Tracker | How to Stay Safe | Heat Waves, Explained

# *Heat Singes the Mind, Not Just the Body*

Hot weather can destabilize mood, exacerbate mental health disorders and complicate drug treatment. Climate change itself is a stressor, scientists say.

Share full article

An unhoused person trying to stay cool during a heat wave in Phoenix last month, where temperatures remained above 110 degrees Fahrenheit for a record 31 consecutive days. Patrick T. Fallon/Agence France-Presse — Getty Images

The New York Times

# *How Extreme Heat Causes Cascading Crises*

Power grids and hospitals can be overwhelmed, but there are fixes.

Share full article

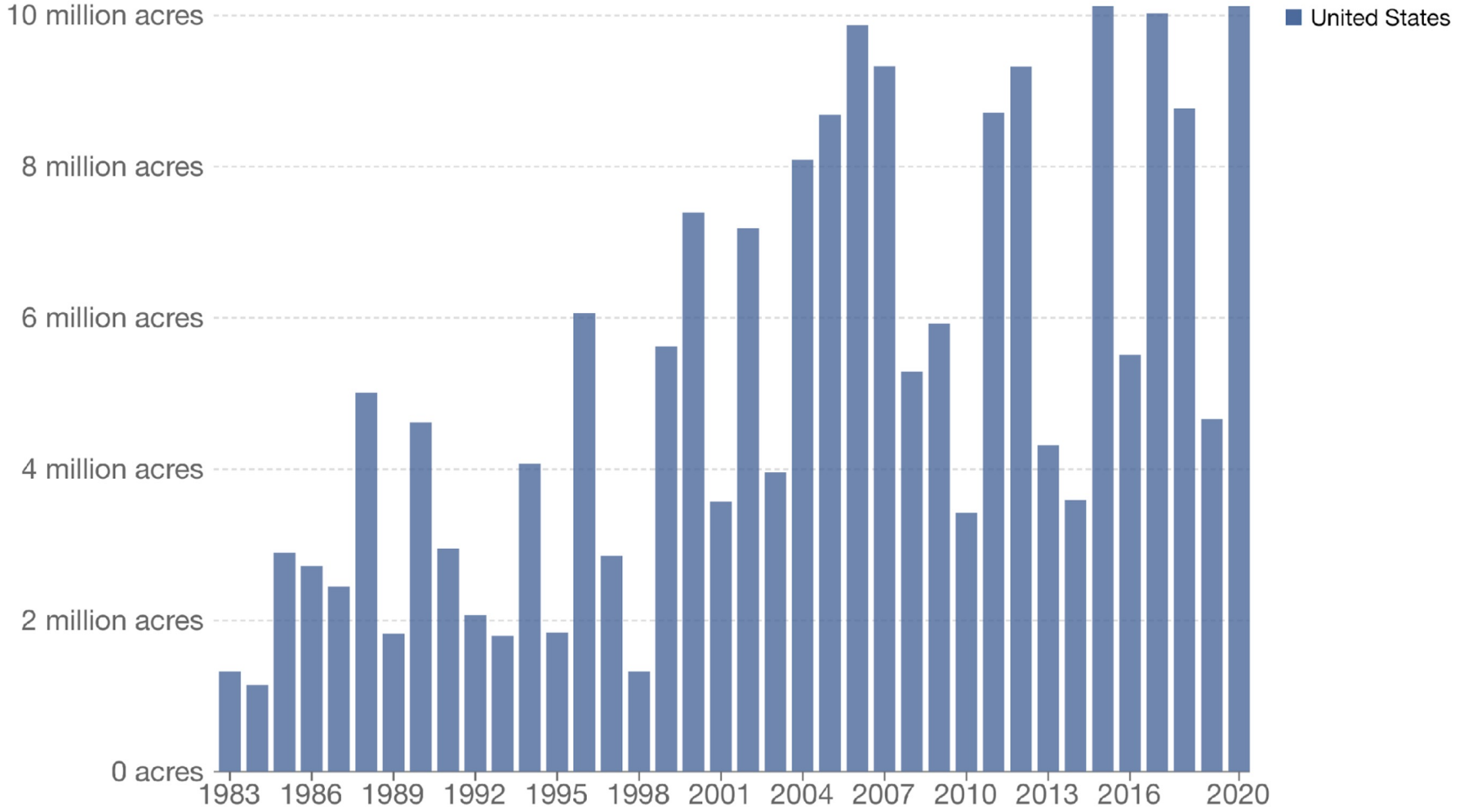
Multiday blackouts amid extreme heat could send almost half the population of Phoenix to the emergency room, researchers concluded. Caitlin O'Hara for The New York Times

Sengupta S. How Extreme Heat Causes Cascading Crises. The New York Times. https://www.nytimes.com/2023/05/26/climate/extreme-heat-hospitals.html. Published May 26, 2023. Accessed August 10, 2023.

Heat Singes the Mind, Not Just the Body - The New York Times. Accessed August 10, 2023. https://www.nytimes.com/2023/08/10/health/heat-mental-health.html

# Wildfire acres burned in the United States

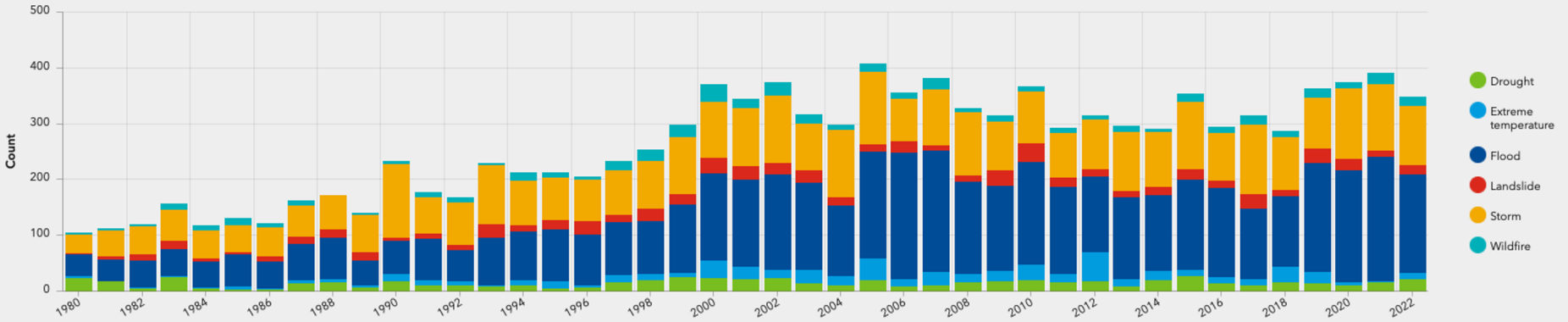
Number of acres of wildfire burned in a given year in the United States. This is shown from 1983 onwards, when consistent reporting began.




Source: National Interagency Fire Center (NIFC)

OurWorldInData.org/natural-disasters • CC BY

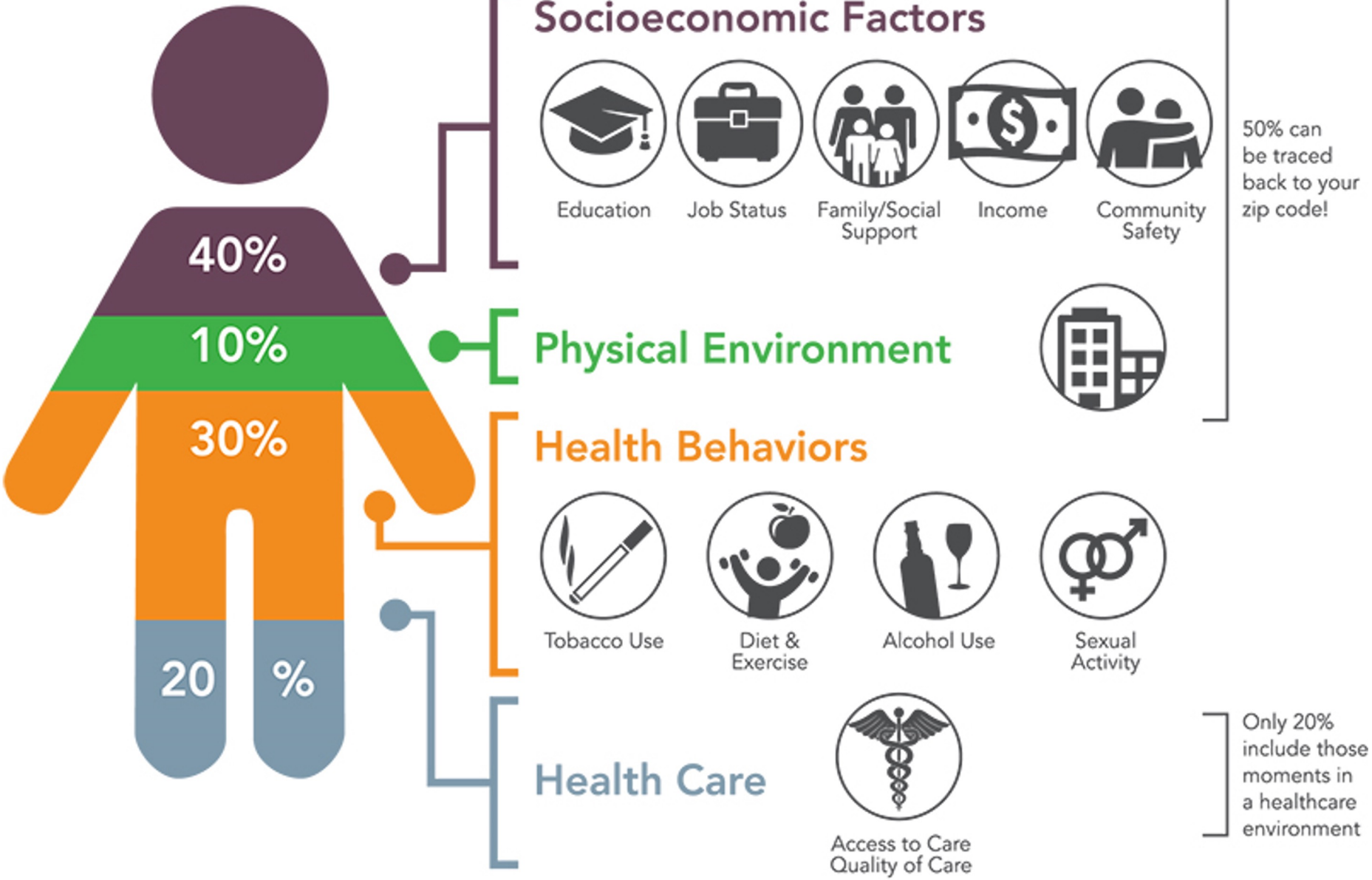
## Frequency of Natural Disasters




Source: EM-DAT, CRED / UCLouvain, Brussels, Belgium.

https://climatedata.imf.org/pages/climatechange-data

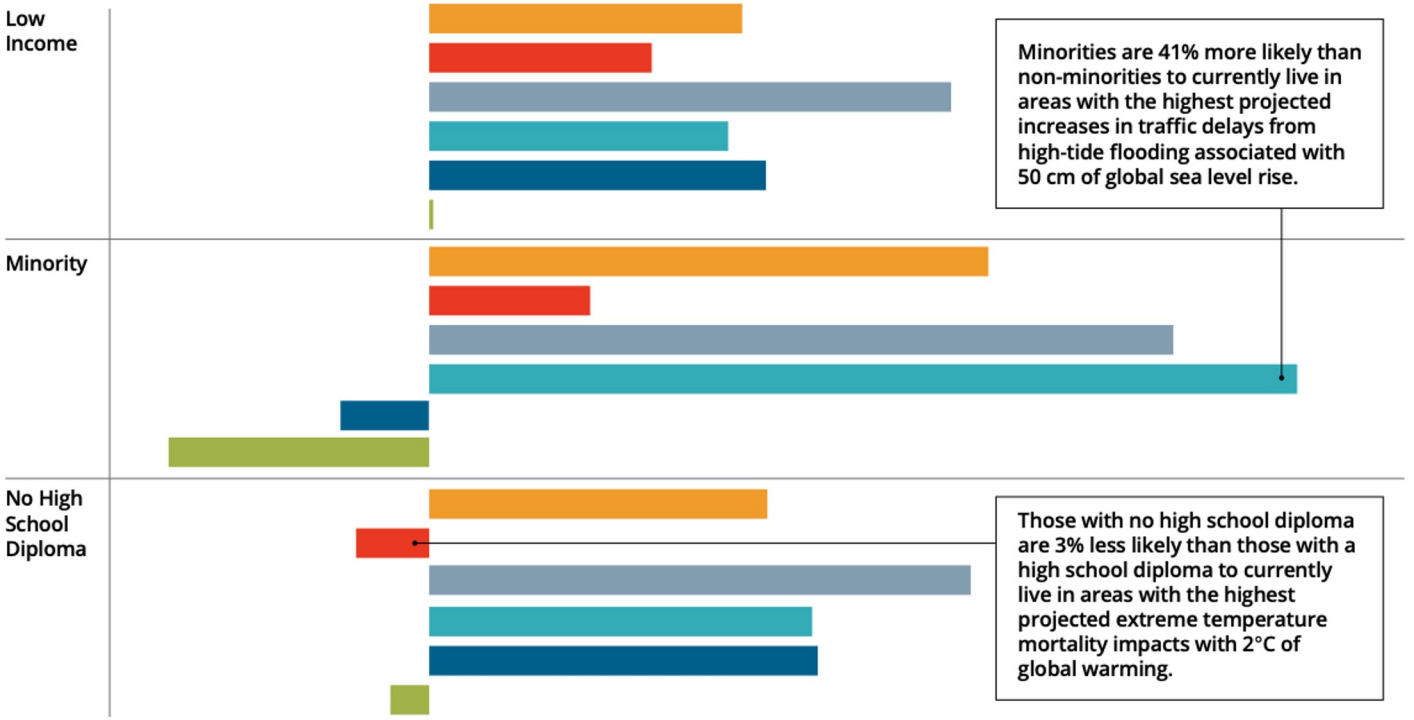
# 3. The social determinants of environmental health




Source: Institute for Clinical Systems Improvement, Going Beyond Clinical Walls: Solving Complex Problems (October 2014)

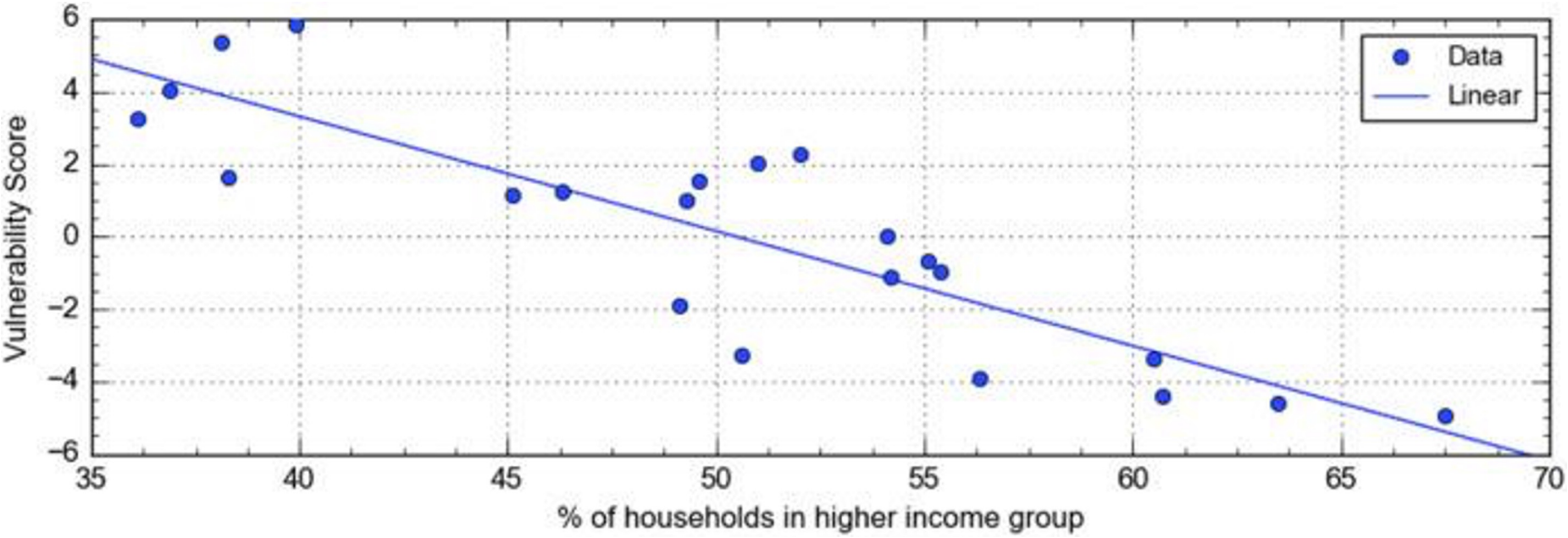

CONTAINER
S-32
(clear)

Risk to socially vulnerable groups with 2°C of global warming, as compared to reference group.




EPA. 2021. Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts. U.S. Environmental Protection Agency, EPA 430-R-21-003. https://www.epa.gov/cira/social-vulnerability-report

# Vulnerability to floods for different income levels




Deria A, Ghannad P, Lee YC. Evaluating implications of flood vulnerability factors with respect to income levels for building long-term disaster resilience of low-income communities. International Journal of Disaster Risk Reduction. 2020;48:101608. doi:10.1016/j.ijdrr.2020.101608

# Share of workers in occupations at increased risk for climate-related health impacts across income level


Ndugga N, Pillai D, Artiga S. Climate-Related Health Risks Among Workers: Who is at Increased Risk? KFF. https://www.kff.org/racial-equity-and-health-policy/issue-brief/climate-related-health-risks-among-workers-who-is-at-increased-risk/. Published June 26, 2023. Accessed March 8, 2024.

# Neighborhood tree-cover across income level


Tree-cover rating:
**81%**

Median household income:
**$205,750**


Tree-cover rating:
**64%**

Median household income:
**$78,523**

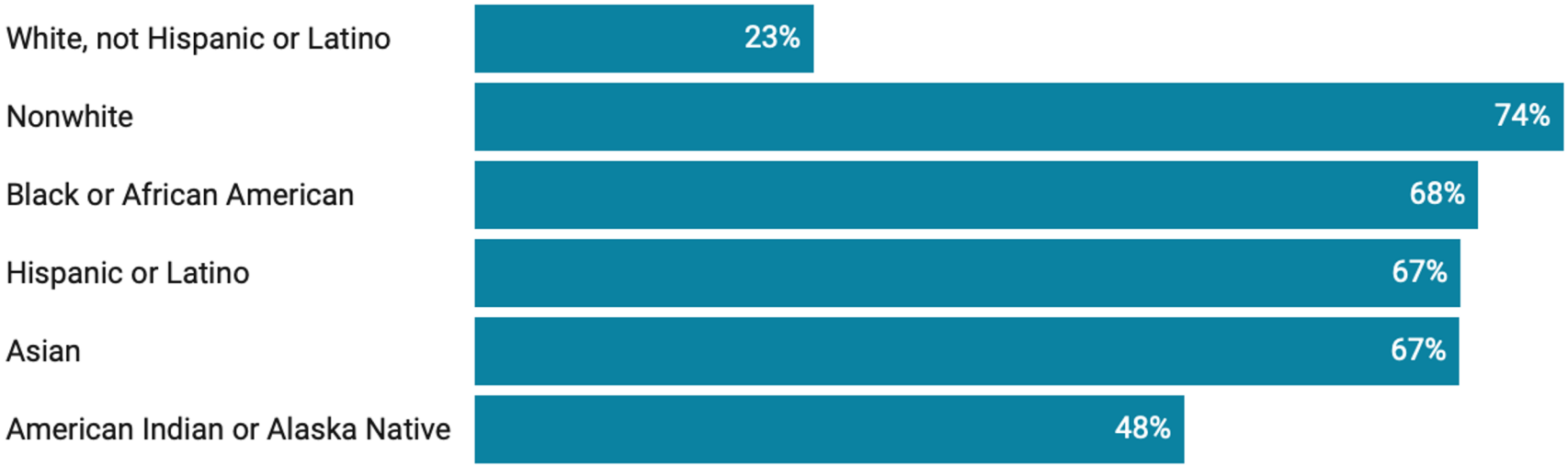

Tree-cover rating:
**48%**

Median household income:
**$36,250**

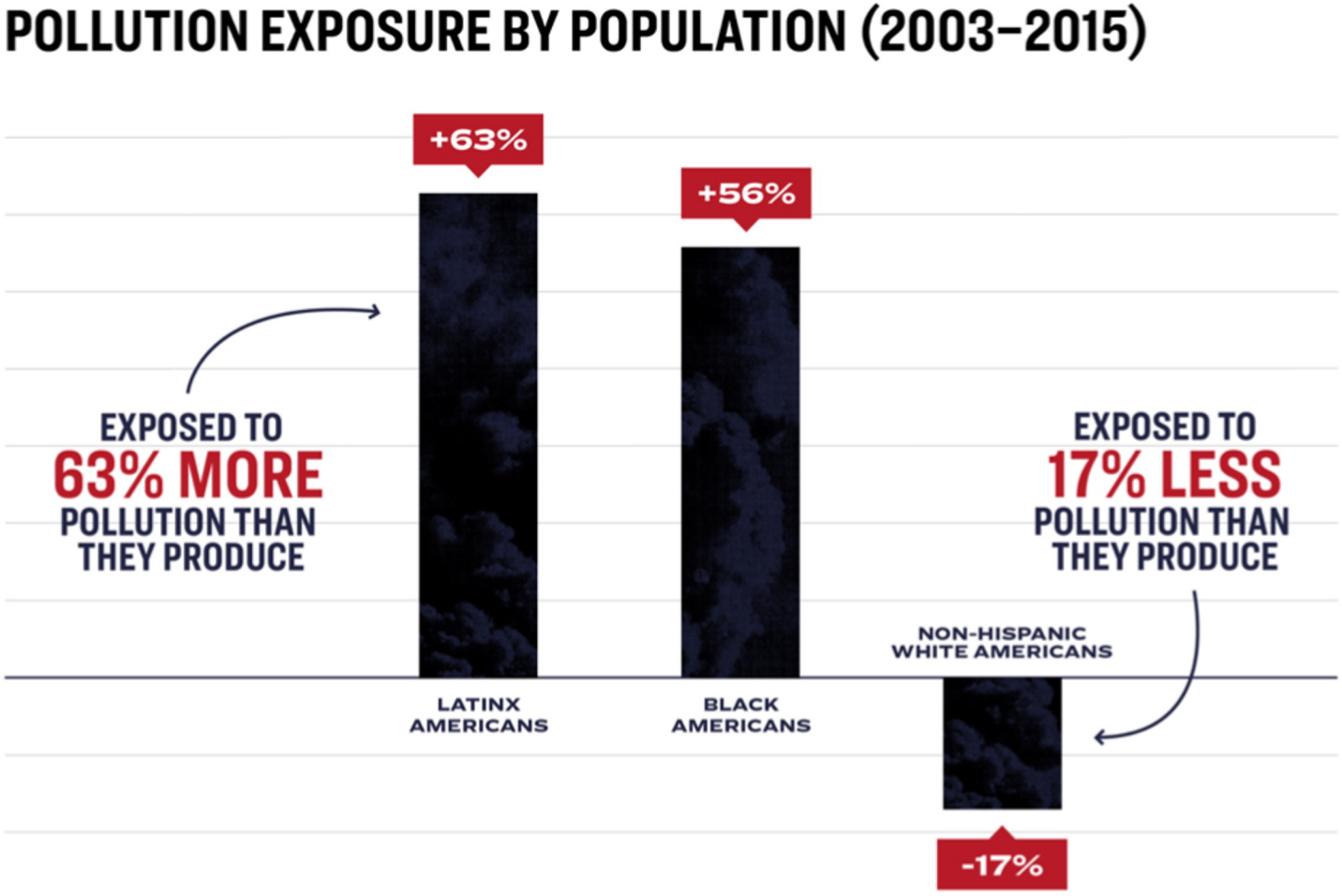
Gowen A, Mellnik T. Environmentalists face challenges trying to plant in less-green neighborhoods. The Washington Post. https://www.washingtonpost.com/local/environmentalists-face-challenges-trying-to-plant-in-less-green-neighborhoods/2013/04/25/21294968-ad27-11e2-a198-99893f10d6dd_story.html. Published April 26, 2013. Accessed March 8, 2024. https://www.europenowjournal.org/2021/05/10/urban-green-spaces-combining-goals-for-sustainability-and-placemaking/

# People of color are more likely than white people to live in an area that is nature deprived

Percent of people living in a nature-deprived area by census tract demographics in the United States, 2017

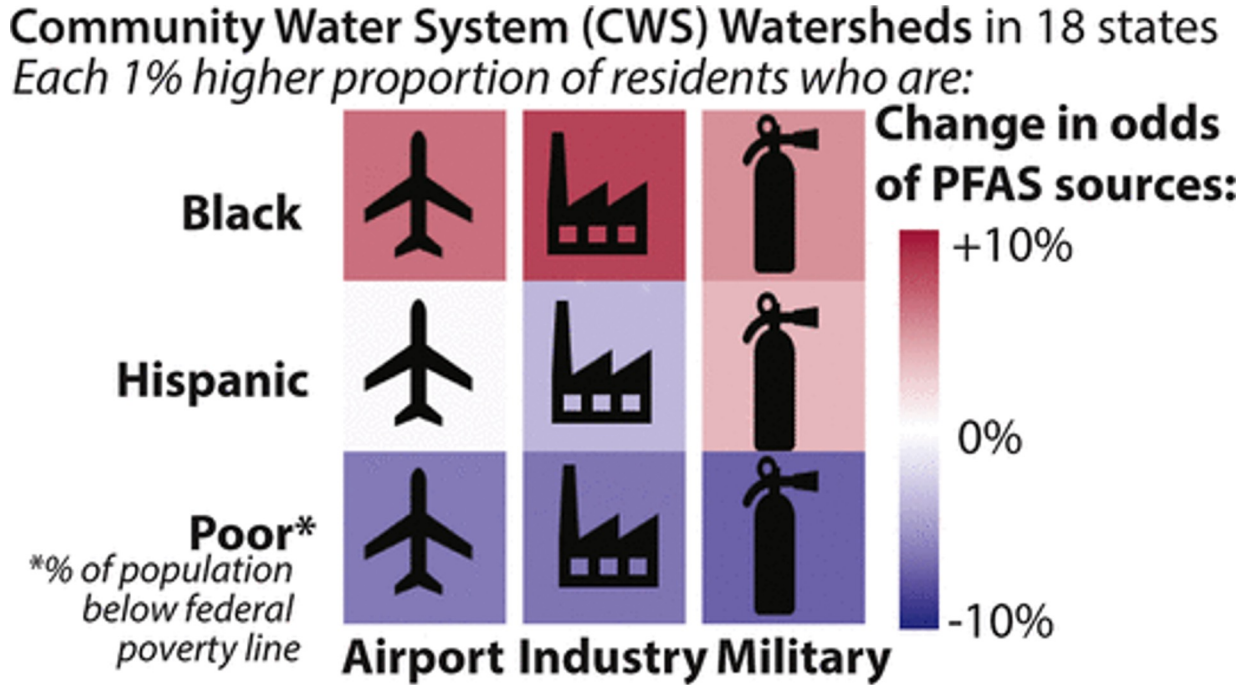



https://www.americanprogress.org/article/the-nature-gap/

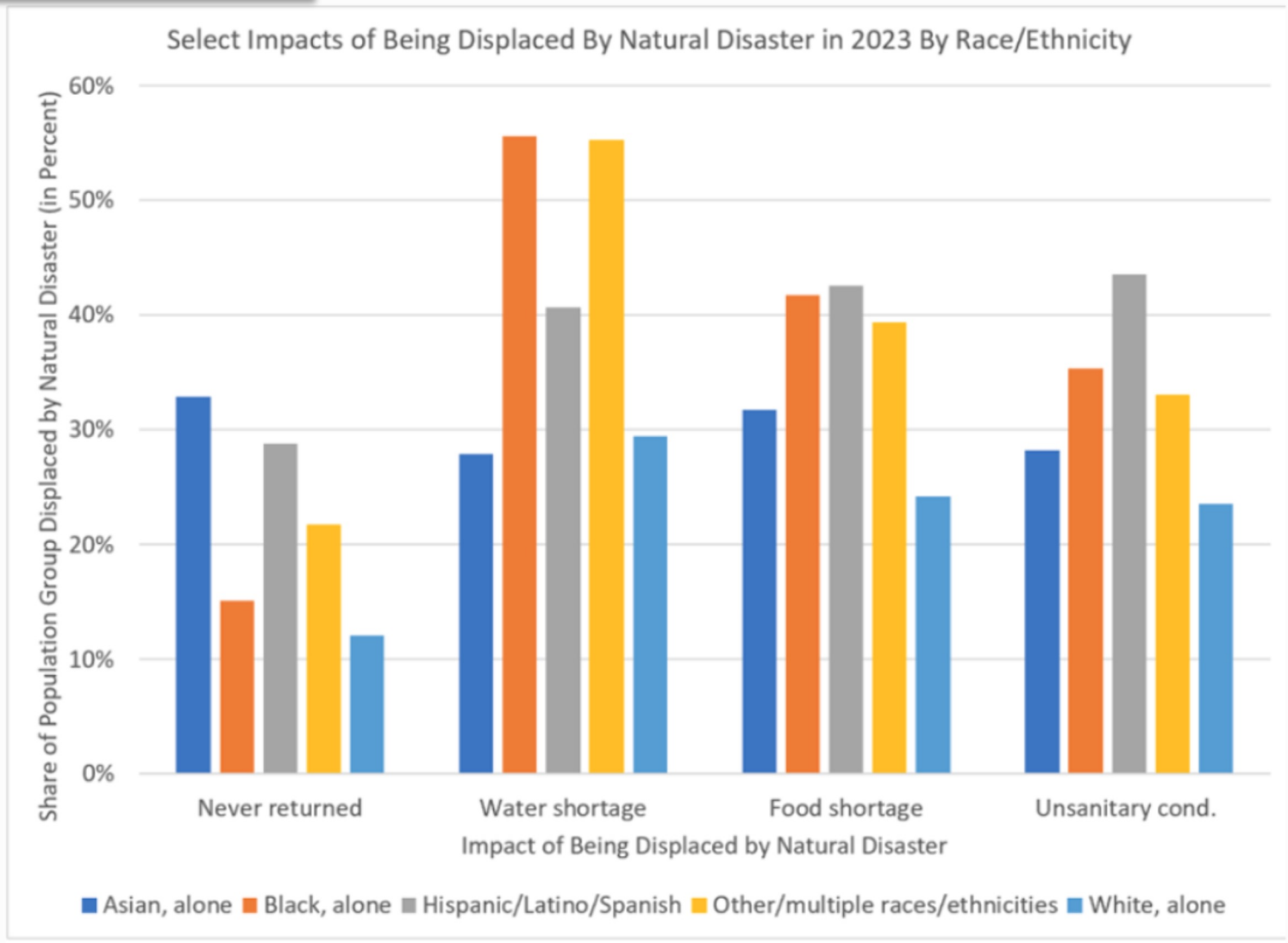



Tessum CW, Apte JS, Goodkind AL, et al. Inequity in consumption of goods and services adds to racial-ethnic disparities in air pollution exposure. Proc Natl Acad Sci USA. 2019;116(13):6001-6006. doi:10.1073/pnas.1818859116

# Exposure to forever chemicals in water supply

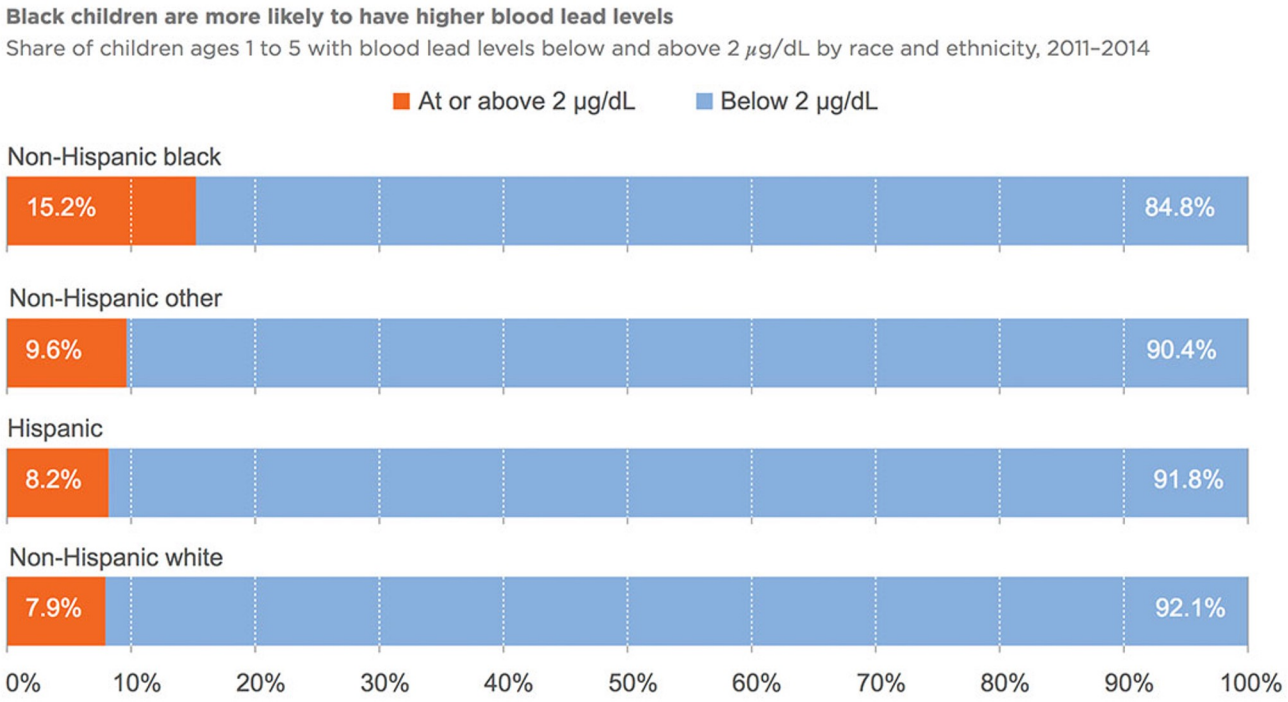



Liddie JM, Schaider LA, Sunderland EM. Sociodemographic Factors Are Associated with the Abundance of PFAS Sources and Detection in US Community Water Systems. Environmental Science & Technology. 2023 May 15.




Weller C. Climate Change Worsens Natural Disasters Alongside Racial Inequality. Forbes. https://www.forbes.com/sites/christianweller/2023/08/17/climate-change-worsens-natural-disasters-alongside-racial-inequality/?sh=7b81bb6e7c74Published August 17, 2023. Accessed March 8, 2024.

# Differential exposure to lead




Packtor C, Racial gaps in children's lead levels. Public Health Post. https://www.publichealthpost.org/databyte/racial-gaps-in-childrens-lead-levels/. Published May 24, 2018. Accessed March 8, 2024.

# Share of workers in occupations at increased risk for climate-related health impacts by educational attainment


Ndugga N, Pillai D, Artiga S. Climate-Related Health Risks Among Workers: Who is at Increased Risk? KFF. https://www.kff.org/racial-equity-and-health-policy/issue-brief/climate-related-health-risks-among-workers-who-is-at-increased-risk/. Published June 26, 2023. Accessed March 8, 2024.

# Grueling heat takes toll on outside workers' physical and mental health

Marina E. Franco (Noticias Telemundo for Axios)

BUSINESS

# Forcing people to work in deadly heat is mostly legal in the U.S.

As the planet records some of its highest average temperatures, workers have barely any legal protections from extreme heat

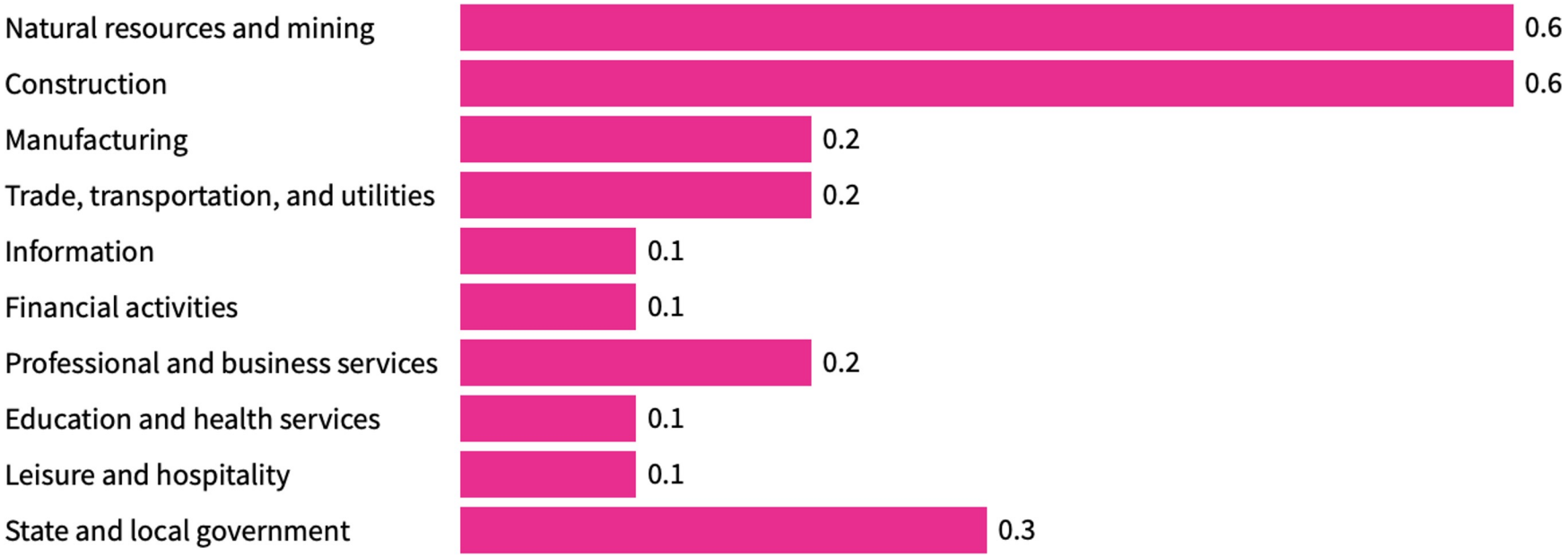
By Jacob Bogage and Eli Tan
July 14, 2023 at 7:00 a.m. EDT

Bogage J, Tan E. **Forcing people to work in deadly heat is mostly legal in the U.S.**

The Washington Post. https://www.washingtonpost.com/business/2023/07/14/heat-workers-osha-protections/. Published July 14, 2023. Accessed March 8, 2024. Franco M. Grueling heat takes toll on outside workers' physical and mental health. Axios. https://www.axios.com/2023/08/15/heat-wave-outside-workers-mental-health. Published August 15, 2023. Accessed March 8, 2024.

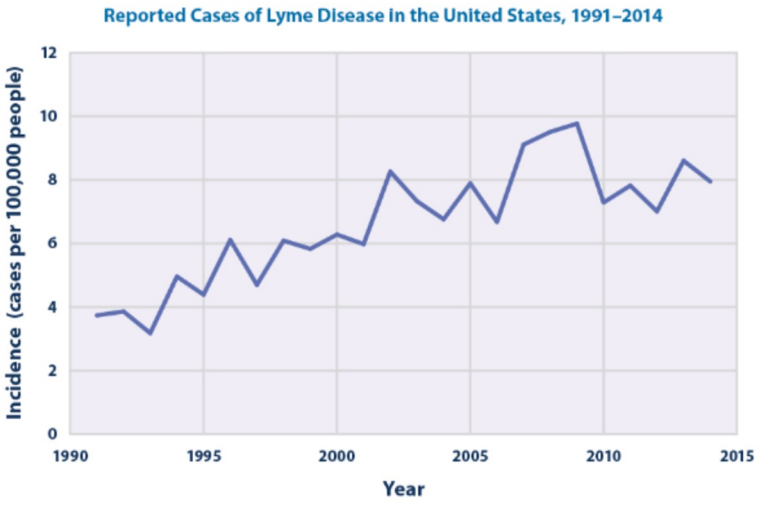
## Workers in natural resources, mining, and construction were most likely to experience an environmental-related heat injury.

Incidence rates for heat-related injuries and illnesses involving days away from work per 10,000 full-time employees, by industry, 2020



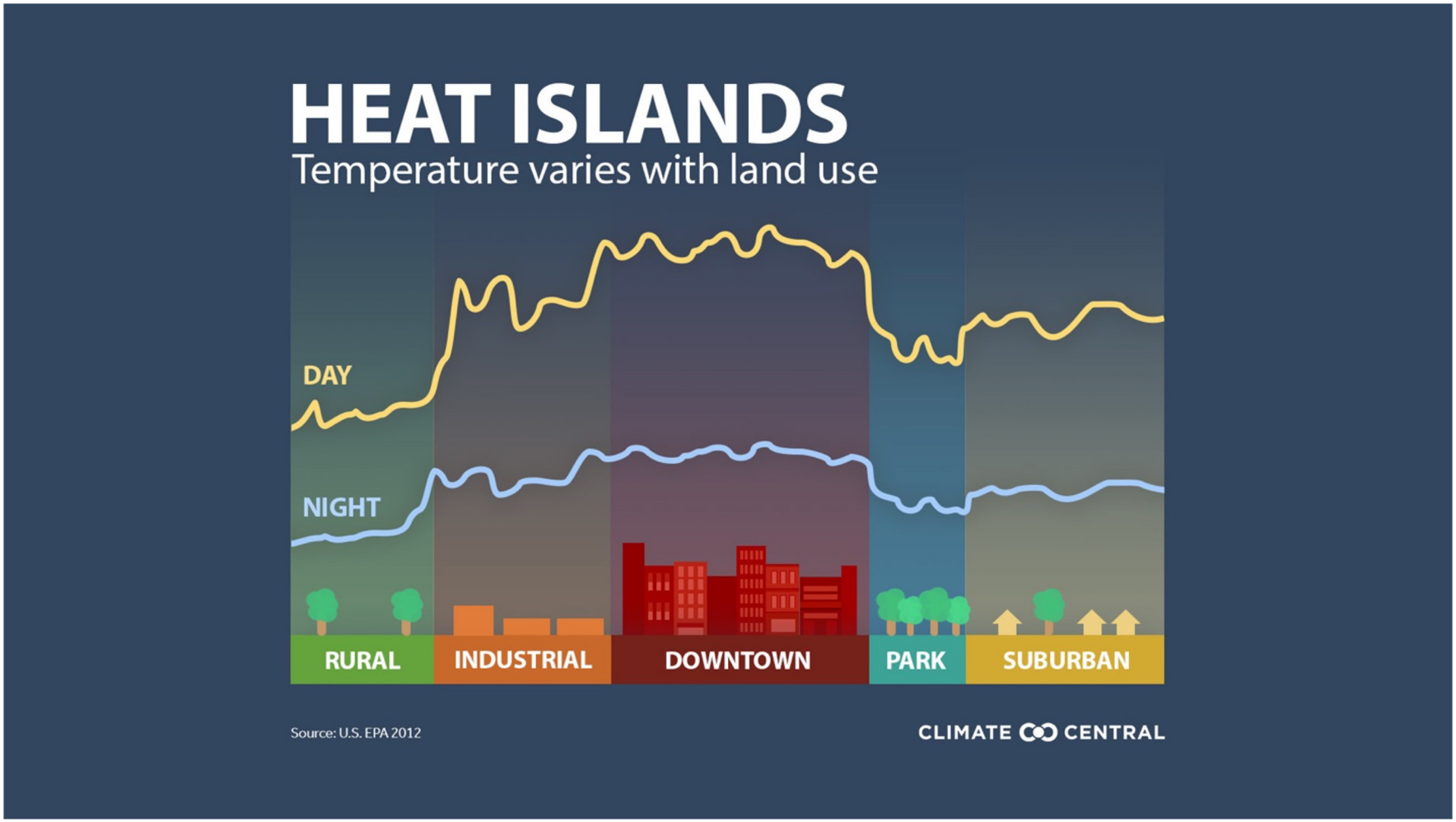

https://usafacts.org/articles/how-dangerous-is-extreme-heat-for-americas-workers/

# Occupational environmental exposures




https://www.epa.gov/climate-indicators/climate-change-indicators-lyme-disease. Verma P, Shaban H, Dennis B, Peiser J, Gregg A. Hazardous air quality from wildfire smoke takes a toll on outdoor workers. The Washington Post. https://www.washingtonpost.com/climate-environment/2023/06/08/workers-outside-hazardous-air-quality-wildfire-smoke/. Published June 8, 2023. Accessed March 8, 2024.

# Urban health risks

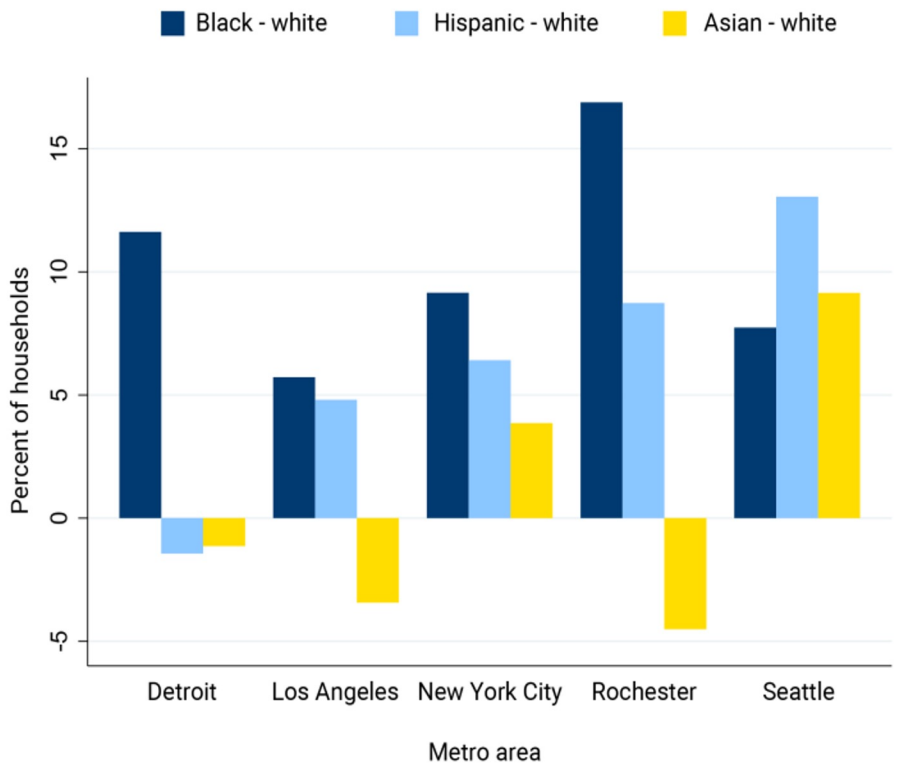



https://www.climatecentral.org/climate-matters/urban-heat-islands-2023#

FIGURE 4

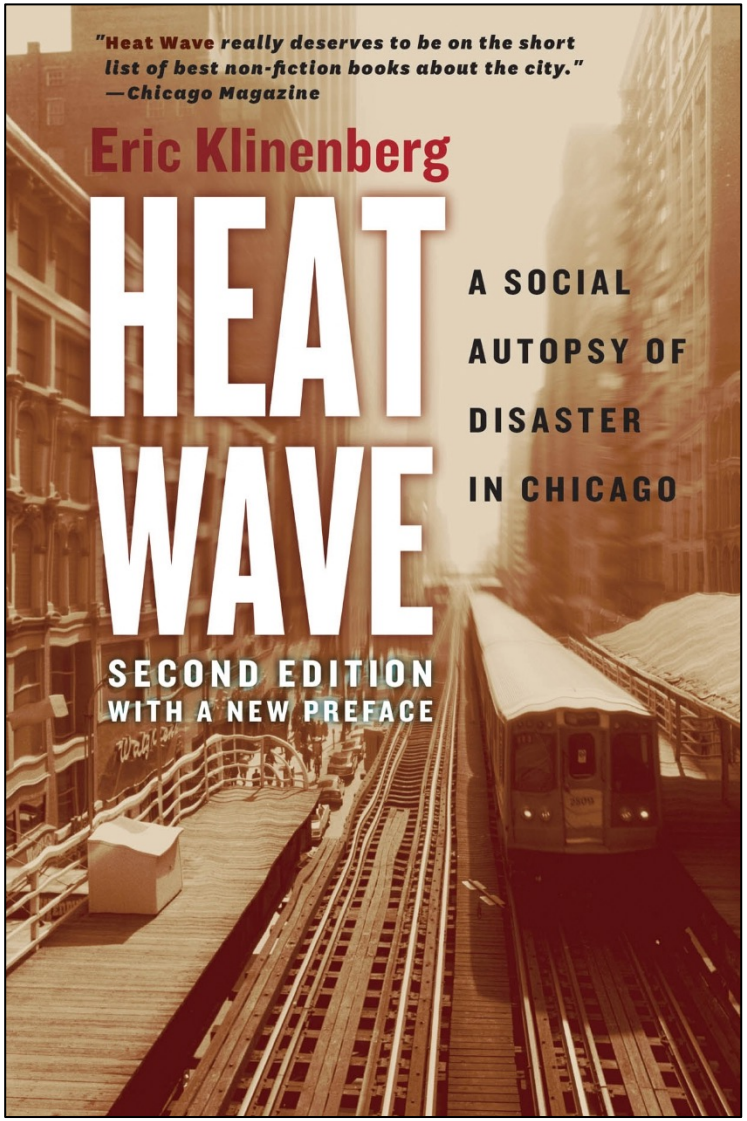
## Black and Latino or Hispanic households are more likely to lack AC

Racial disparities in percent of households with no AC for selected metro areas



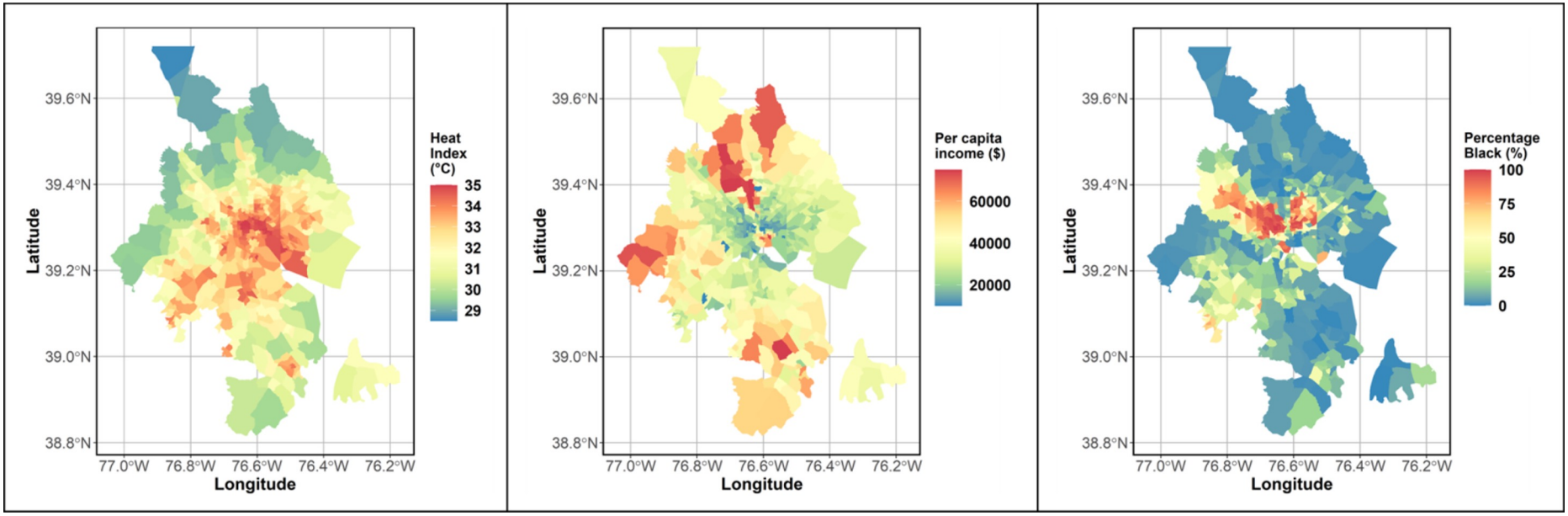

**Source:** Authors' analysis of household-level data from American Housing Survey (Metro 2017, 2019 and National 2019).
**Note:** Metro areas chosen from among those where more than 10% of households have no AC.

Brookings Metro




https://www.brookings.edu/articles/as-extreme-heat-grips-the-globe-access-to-air-conditioning-is-an-urgent-public-health-issue/#:~:text=Like%20exposure%20to%20other%20climate%20risks%2C%20AC%20access%20shows%20a,less%20likely%20to%20have%20AC.

# Disparate impact of urban heat islands




Owen, R. The inequality of heat stress. EOS. https://eos.org/articles/the-inequality-of-heat-stress#:~:text=Census%20tracts%20with%20higher%20income,larger%20percentage%20of%20Black%20residents.&text=The%20researchers%20compared%20these%20findings,race%2Dbased%20disparity%20over%20time. Published July 21, 2023. Accessed March 8, 2024.

# Redlining means 45 million Americans are breathing dirtier air, 50 years after it ended

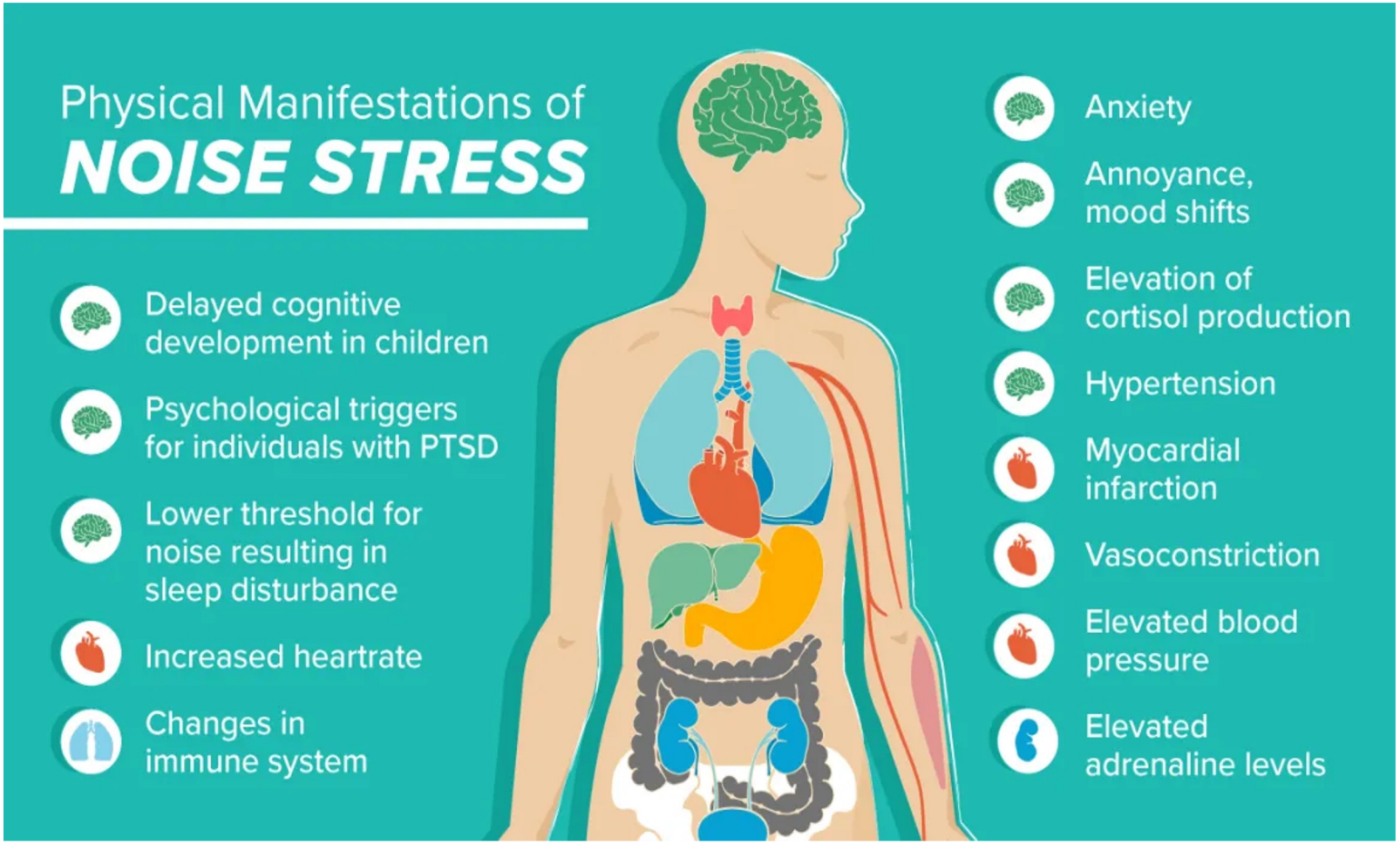
Boyle Heights, a heavily Latino area in Los Angeles singled out for its 'detrimental racial elements,' has one of the highest pollution scores in California

By Darryl Fears

March 9, 2022 at 8:00 a.m. EST

The Boyle Heights area of Los Angeles, reflected in a car window. The community was redlined by federal map drawers from the Home Owners' Loan Corporation in the 1930s. (Jane Hahn for The Washington Post)

Fears D. Redlining means 45 million Americans are breathing dirtier air, 50 years after it ended. The Washington Post. https://www.washingtonpost.com/climate-environment/2022/03/09/redlining-pollution-environmental-justice/. Published March 9, 2022. Accessed March 8, 2024. Tabuchi H, Popovich N. **People of Color Breathe More Hazardous Air. The Sources Are Everywhere.** https://www.nytimes.com/2021/04/28/climate/air-pollution-minorities.html




King G, Roland-Mieszkowski M, Jason T, Rainham DG. Noise levels associated with urban land use. J Urban Health. 2012;89(6):1017-1030. doi:10.1007/s11524-012-9721-7.
https://www.healthline.com/health-news/loud-noises-bad-for-your-health

“Health equity is…the allocation of resources according to need, in a way that preventable differences in health outcomes are minimized, and access is fair.”

Maani N, Abdalla SM, Ettman C, Parsey L, Rhule E, Allotey P, Galea S. Global health equity requires global equity. Under review.
Culyer AJ, Wagstaff A. Equity and equality in health and health care. *Journal of Health Economics* 1993;12(4):431-57. doi: https://doi.org/10.1016/0167-6296(93)90004-X

# Disparities in climate-change related health outcomes

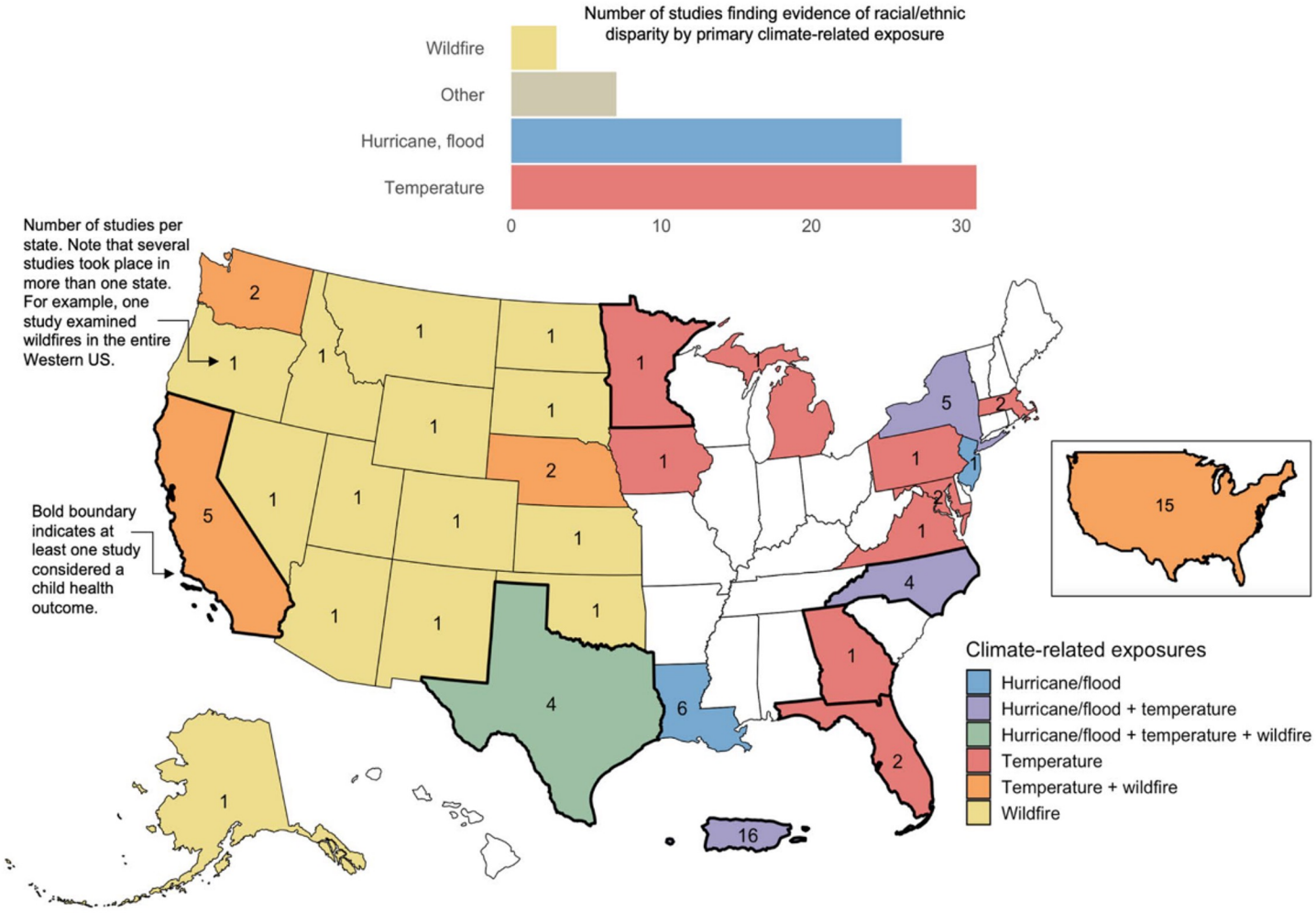
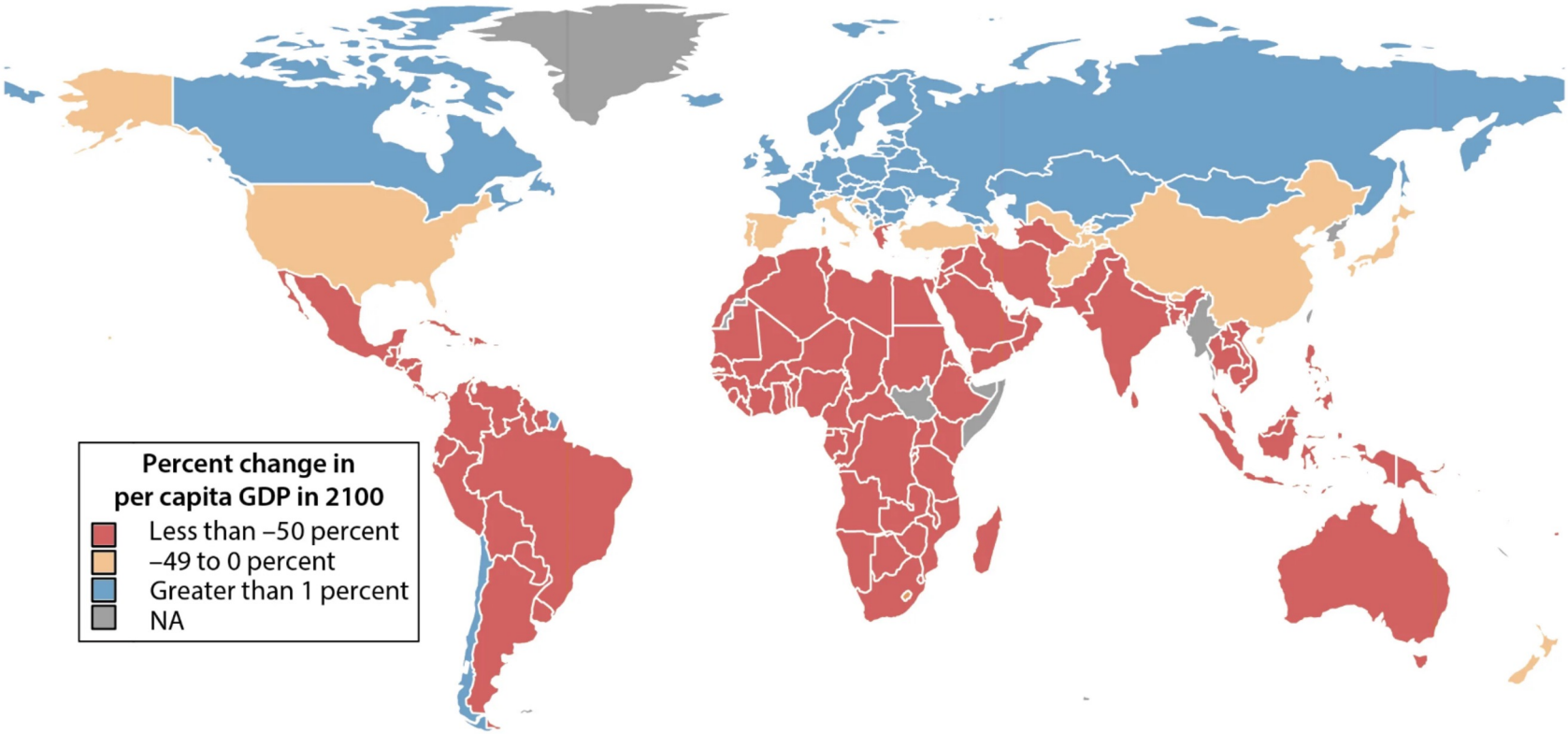



**Fig. 1** Summary of evidence of climate-related health impacts in racially marginalized communities

Berberian AG, Gonzalez DJX, Cushing LJ. Racial Disparities in Climate Change-Related Health Effects in the United States. Curr Environ Health Rep. 2022;9(3):451-464. doi:10.1007/s40572-022-00360-w

FIGURE 3.

## Climate Change Effect on per Capita GDP in 2100 by Country




Source: Burke, Hsiang, and Miguel (2015); authors' calculations.

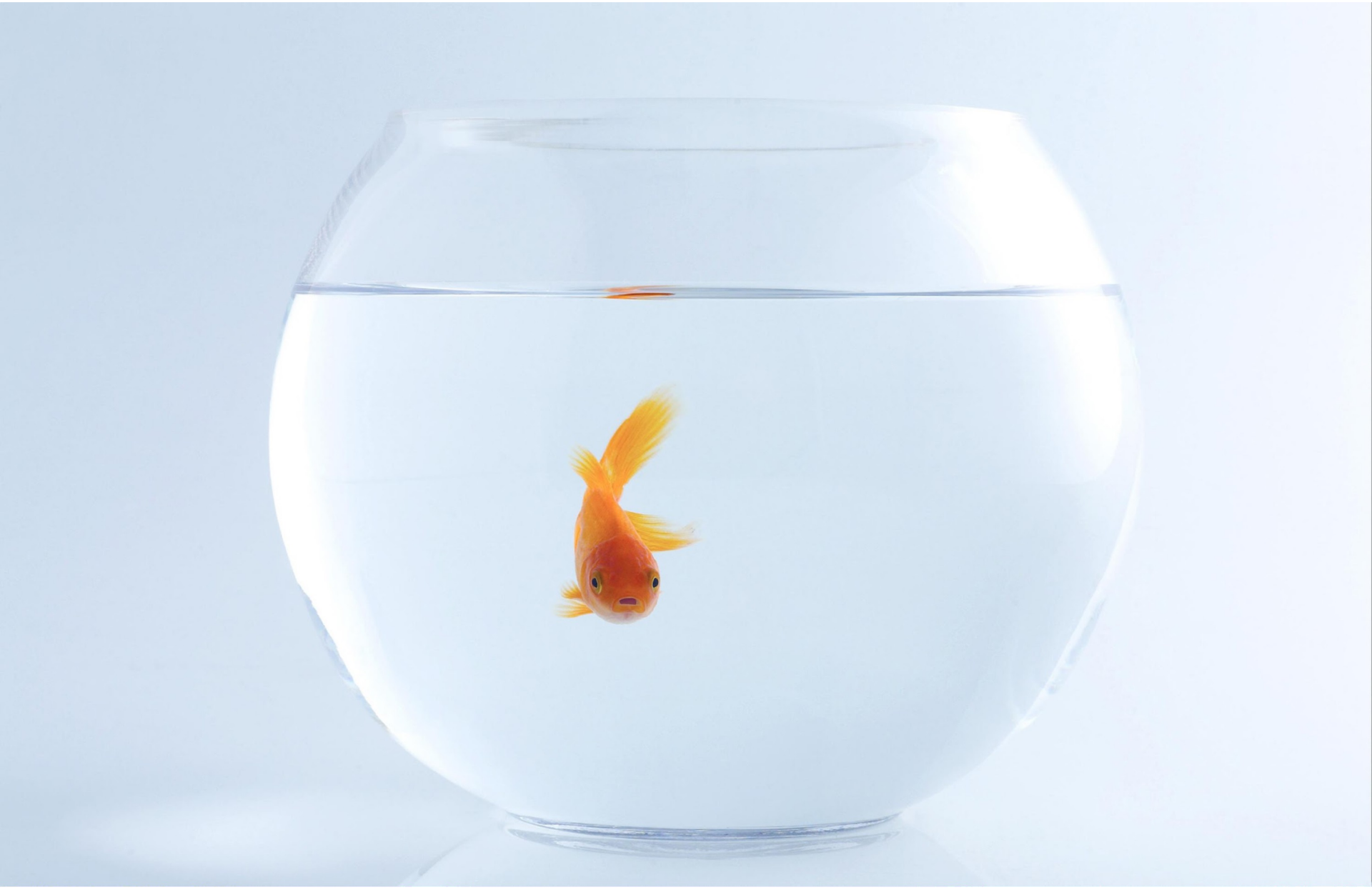
Note: Country-level estimates for GDP per capita in 2100. Figure assumes RCP 8.5, which corresponds to roughly 3.2°C to 5.4°C of warming. GDP loss is associated with the warming from a baseline of 1980–2010 average temperatures. As explained in Burke, Hsiang, and Miguel (2015), estimates include growth-rate effects over the period through 2100.

THE HAMILTON PROJECT BROOKINGS

Stanford | Institute for Economic Policy Research (SIEPR)

https://www.brookings.edu/articles/ten-facts-about-the-economics-of-climate-change-and-climate-policy/

4. How can we think of the social drivers of health?



# Understanding associations

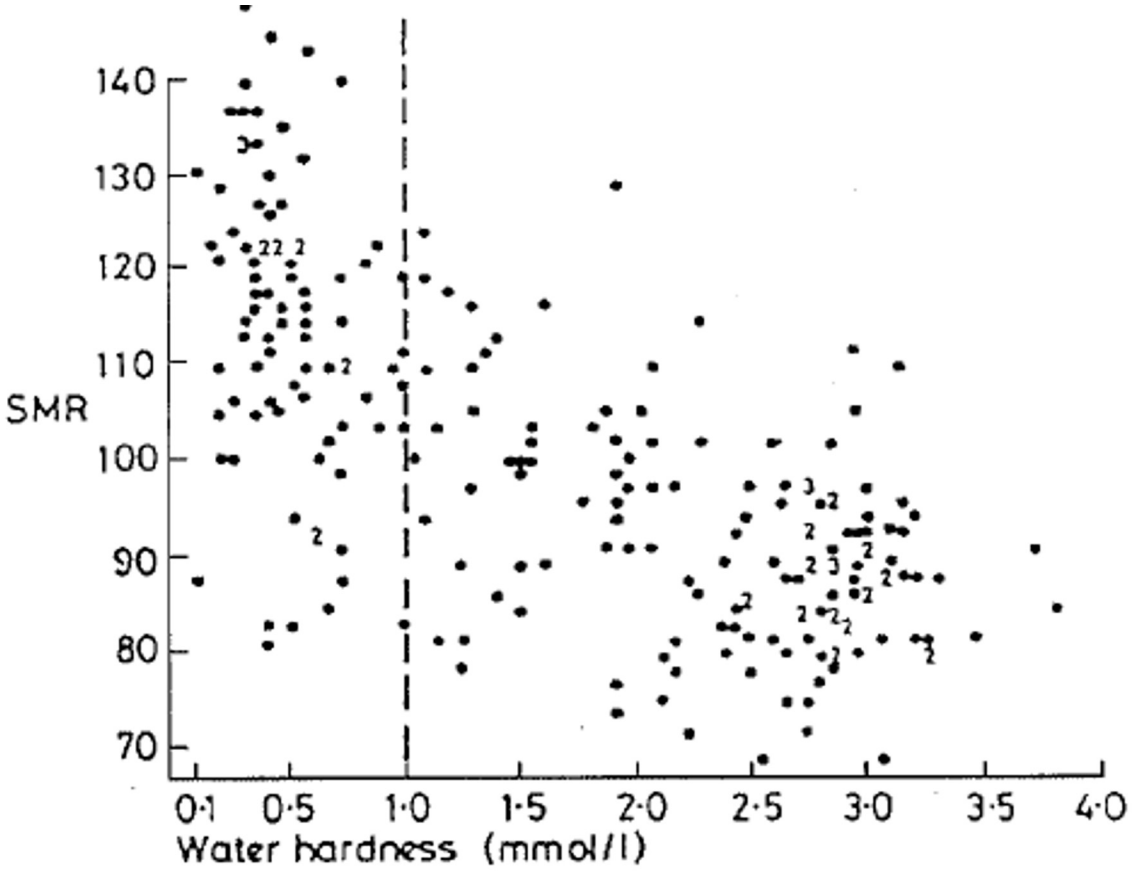



**Figure 1** Relation between water quality and cardiovascular mortality in towns of the UK[1]

Rose G. Sick individuals and sick populations. International Journal of Epidemiology. 1985;14:32-38

# But what if the exposure is ubiquitous?

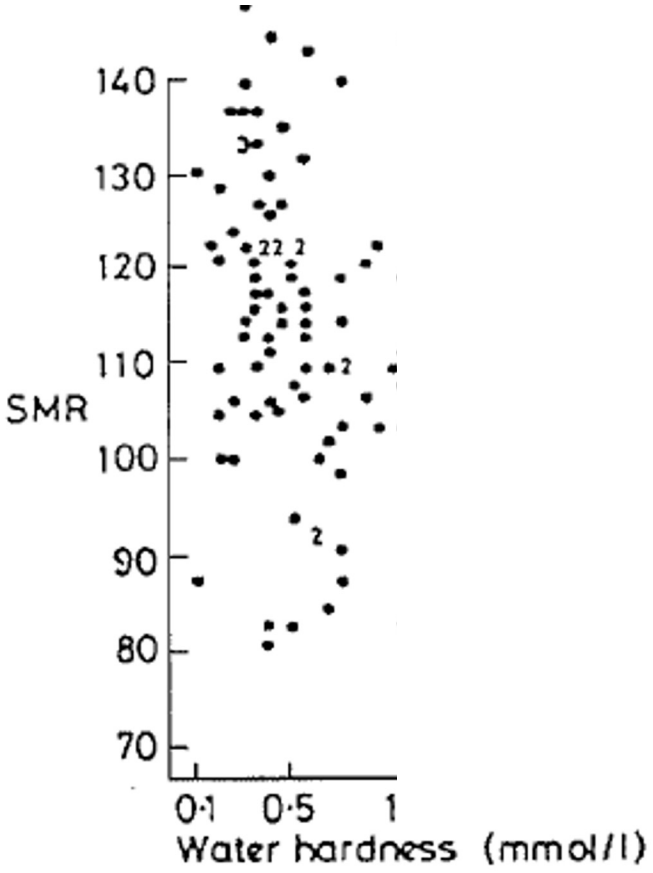


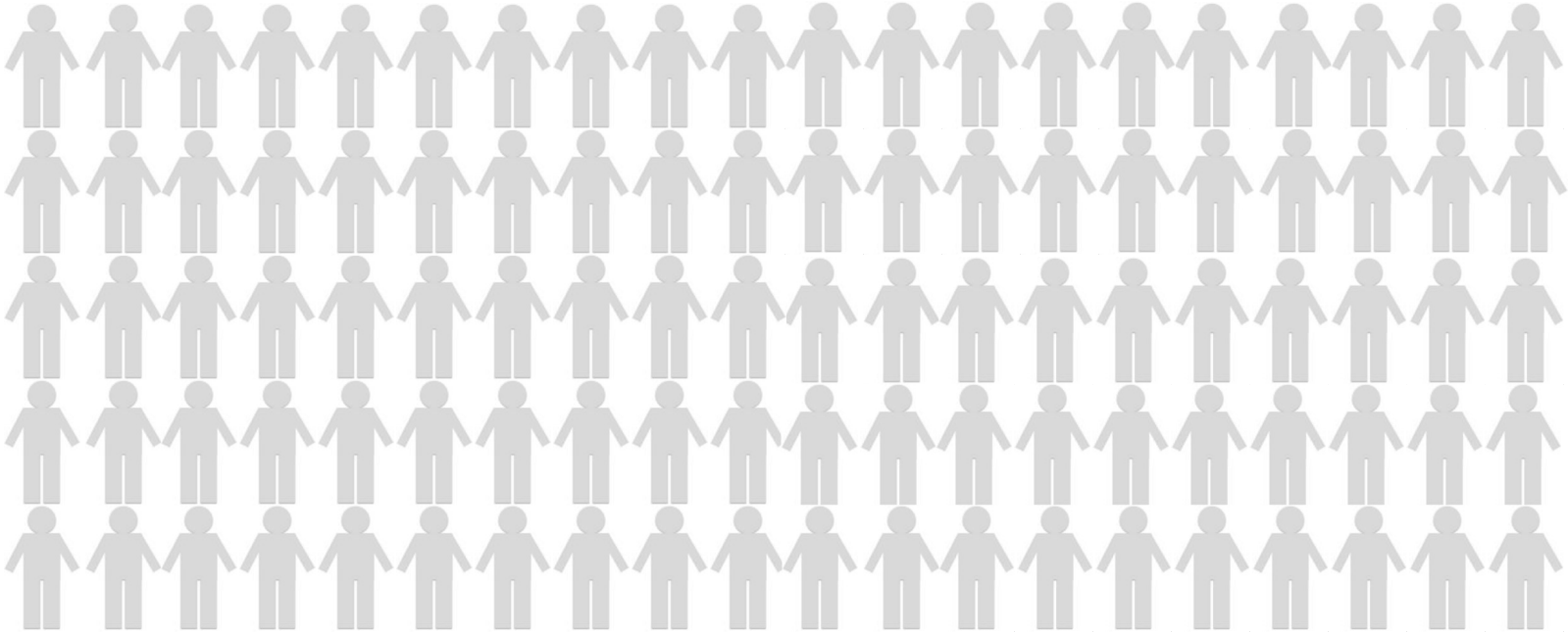

**Figure 1** Relation between water quality and cardiovascular mortality in towns of the UK[1]

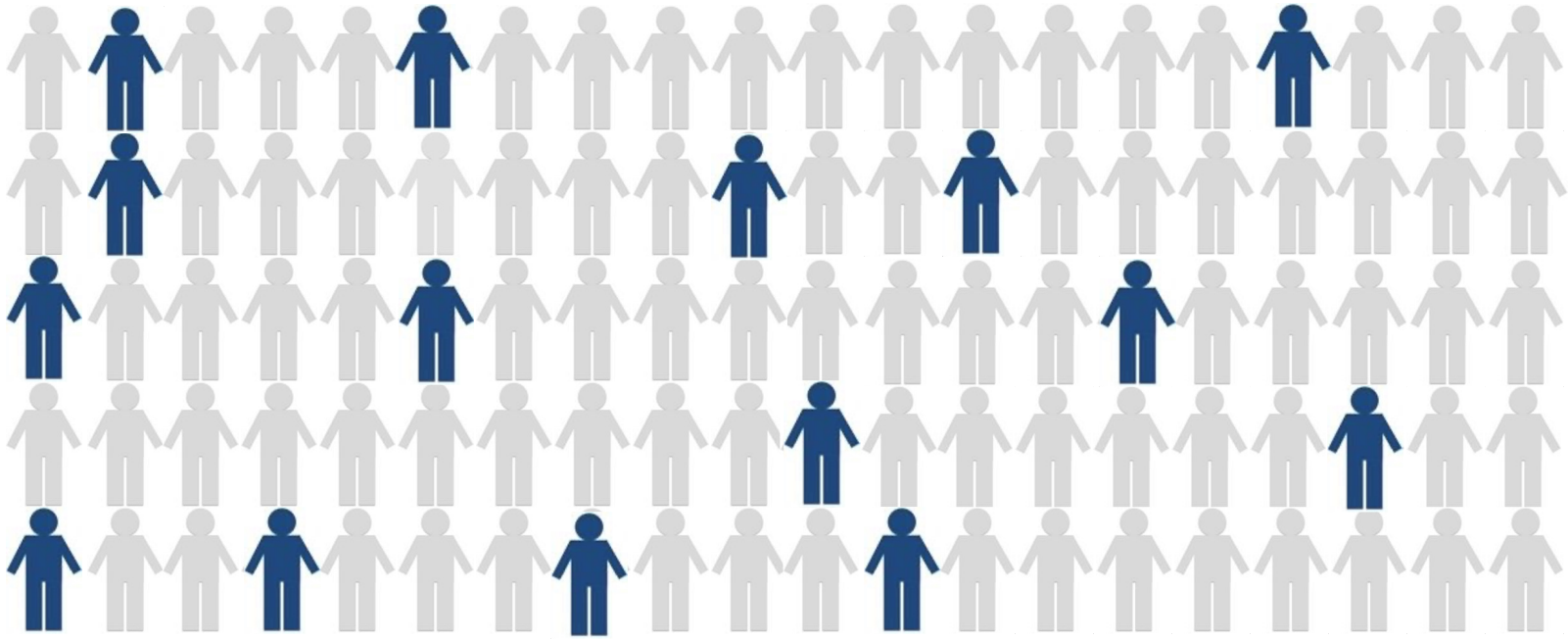
Rose G. Sick individuals and sick populations. International Journal of Epidemiology. 1985;14:32-38

5. Why we cannot ignore the structural factors that shape health

Let us assume two things cause disease: genes and environments

In this example, genetic influence is going to stay the same, but I will vary environmental influence





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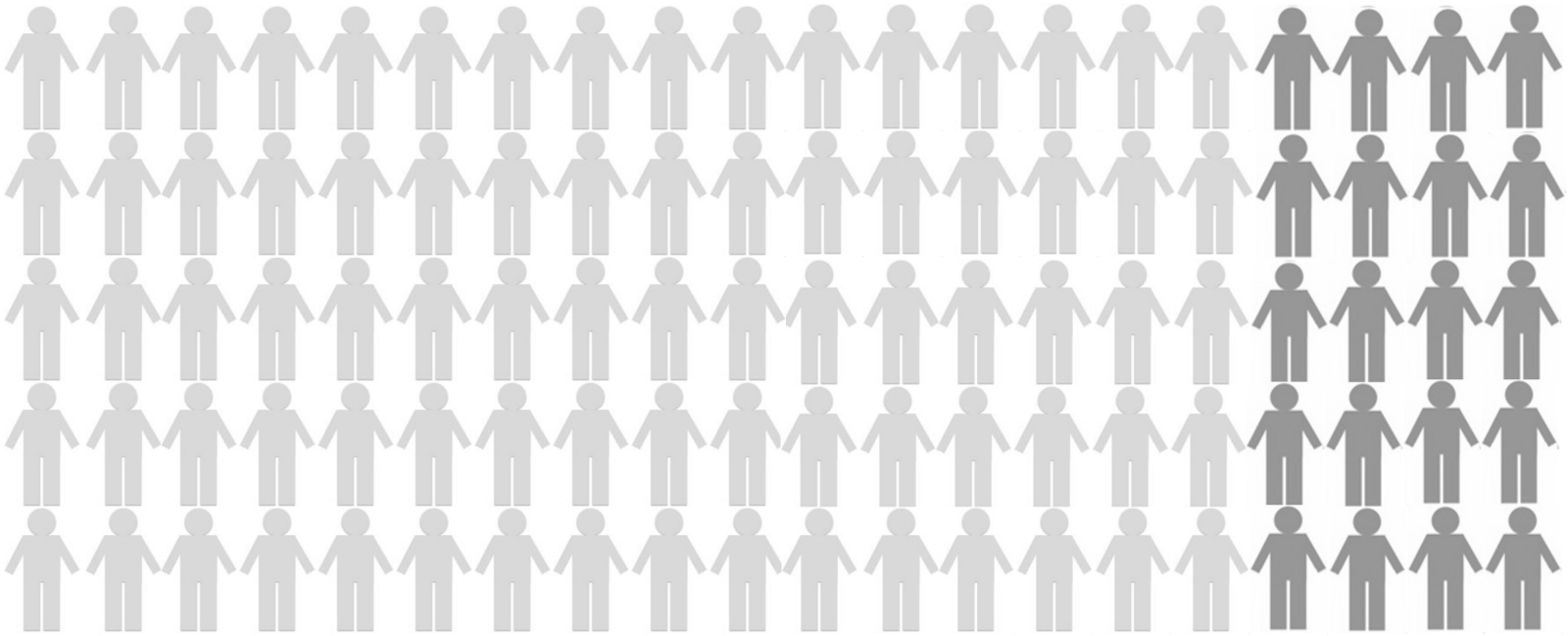

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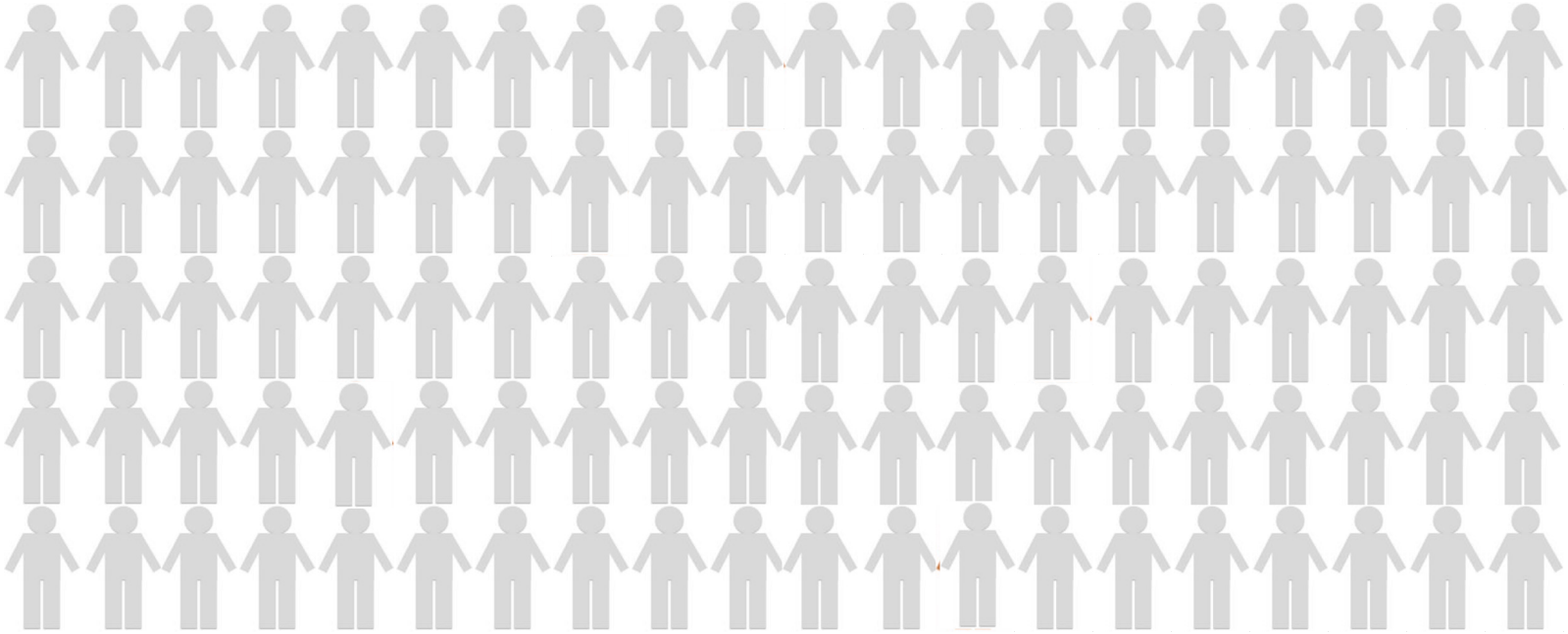

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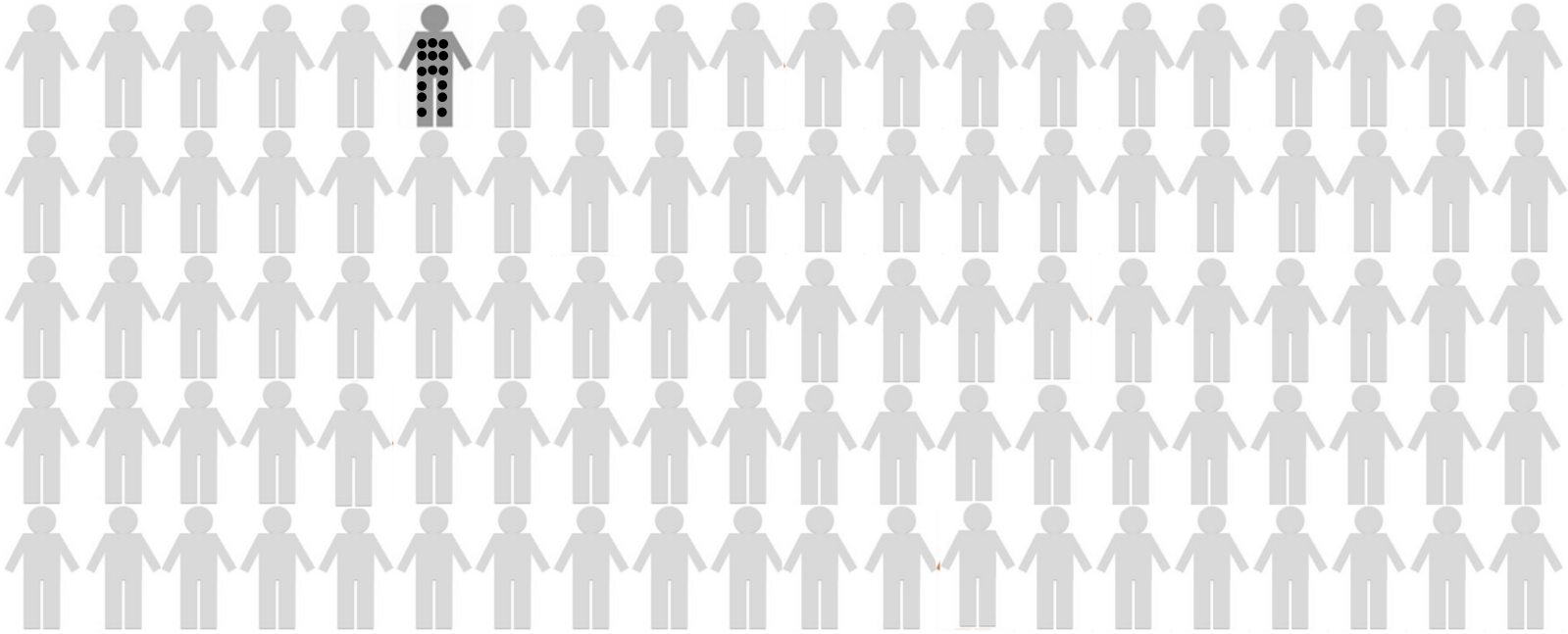

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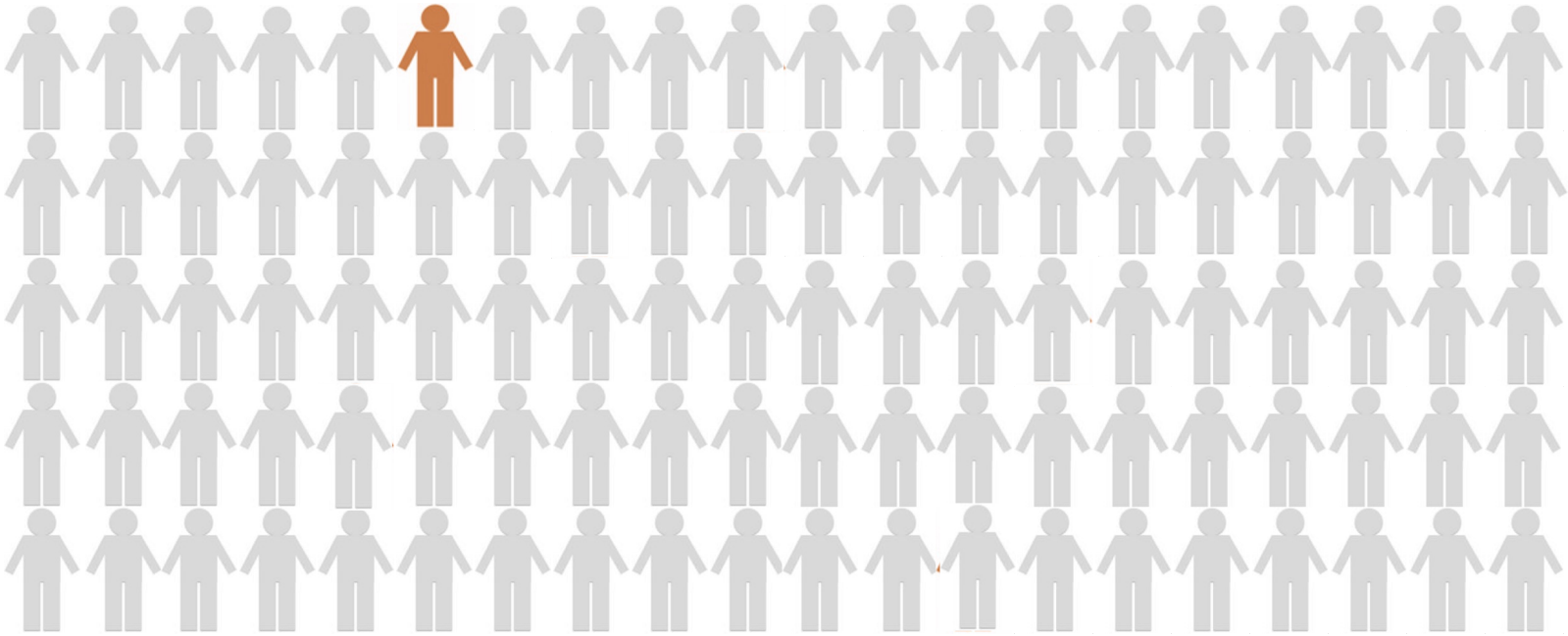

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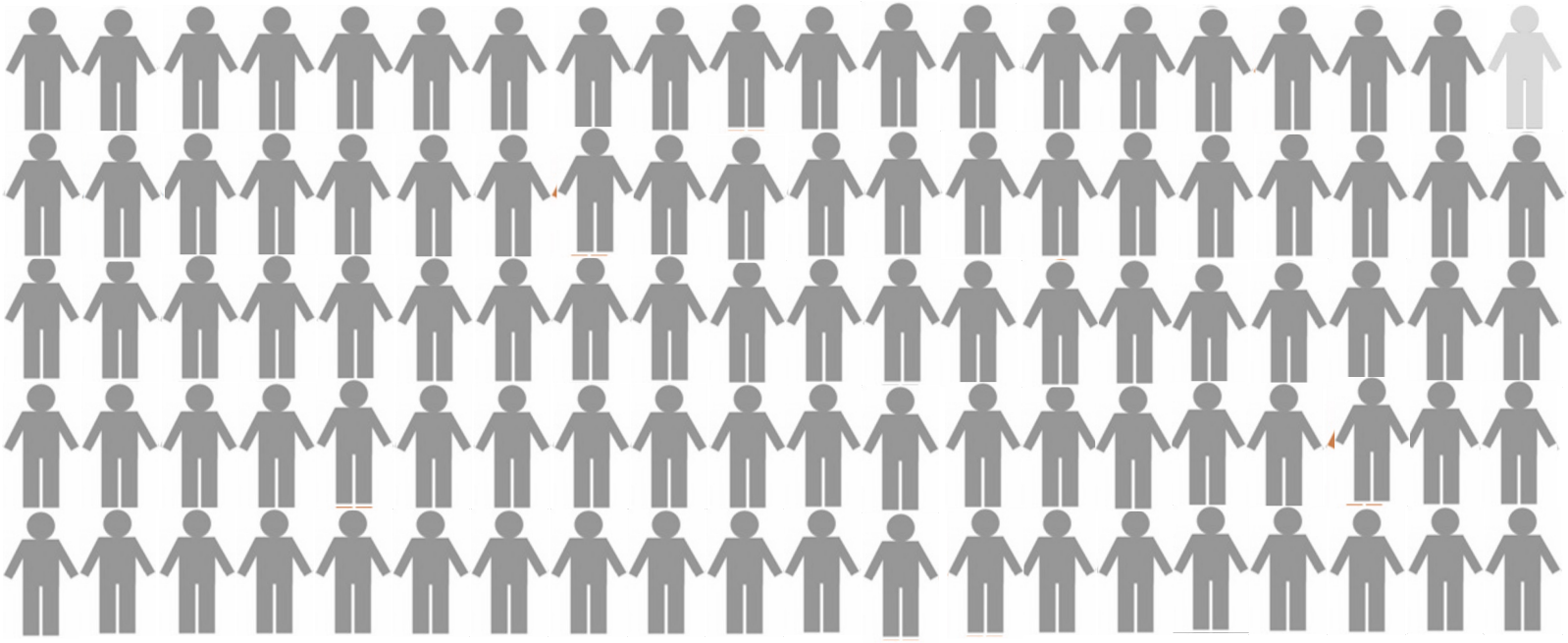
# Scenario 1



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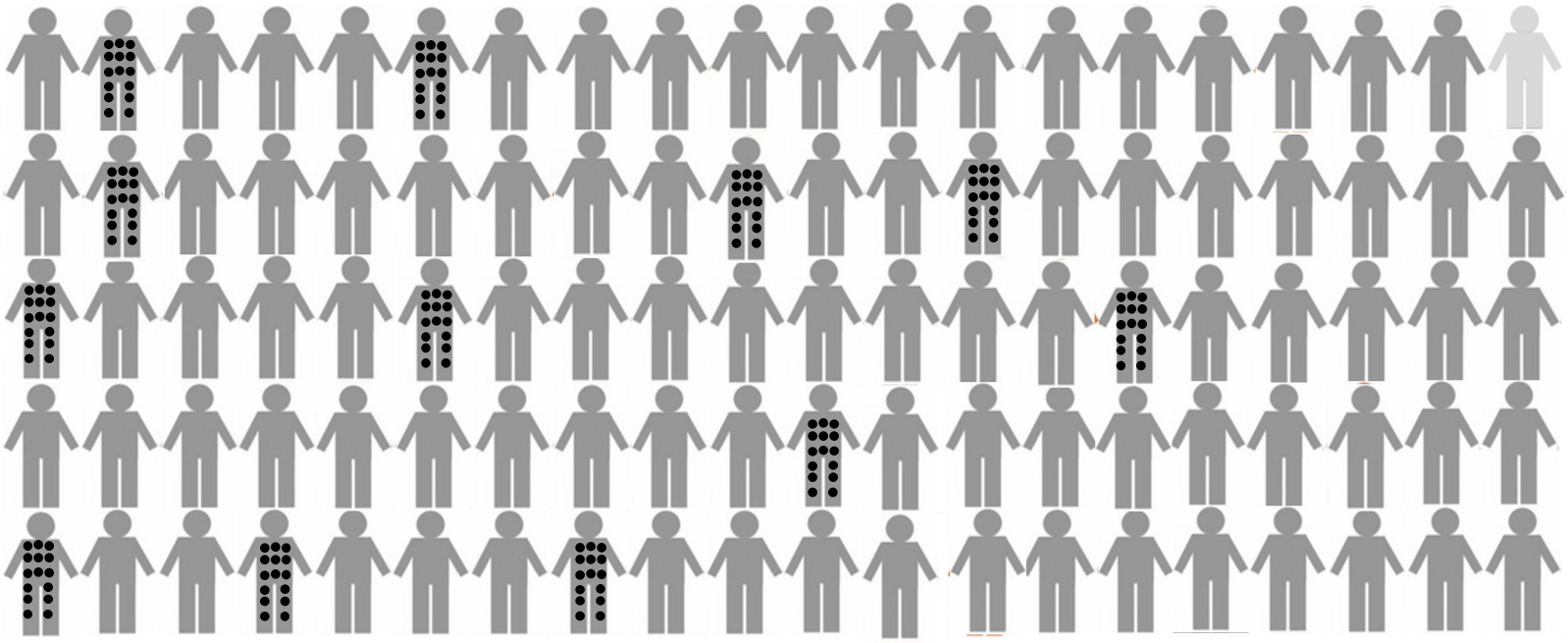
# Scenario 1



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# Scenario 1

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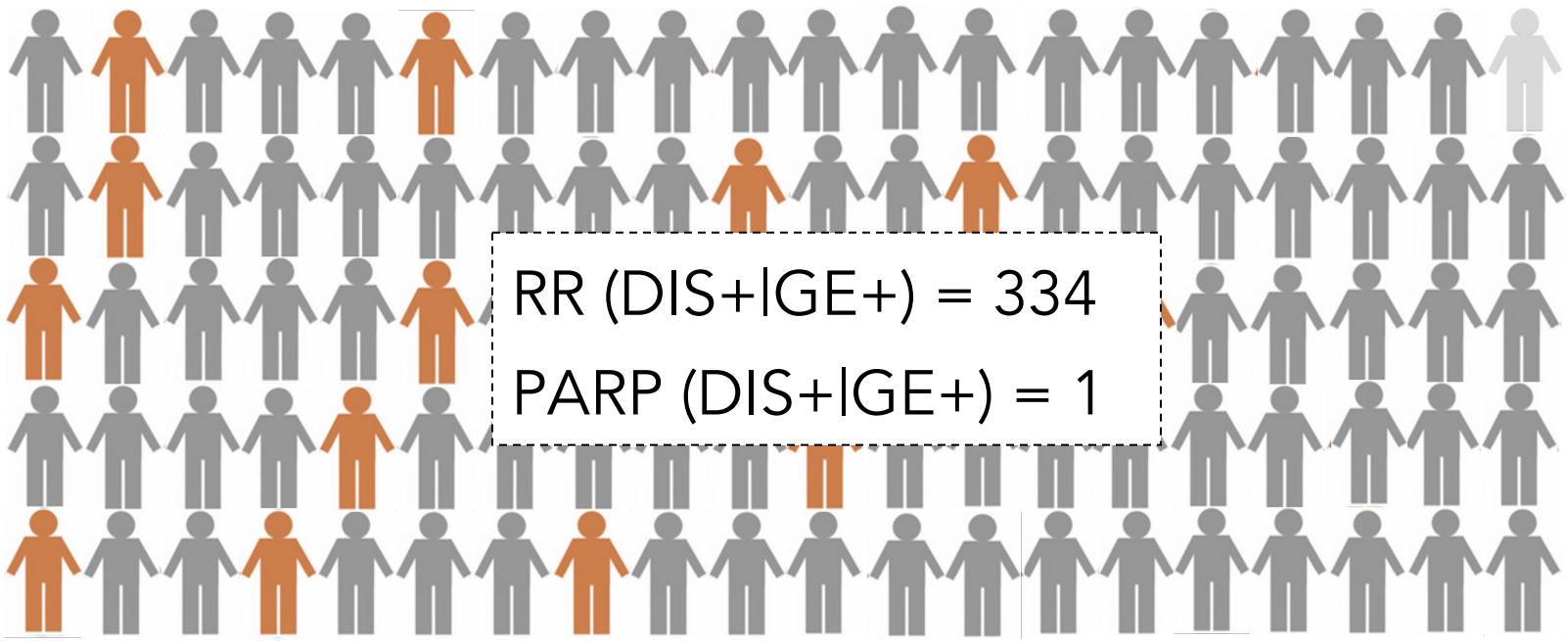


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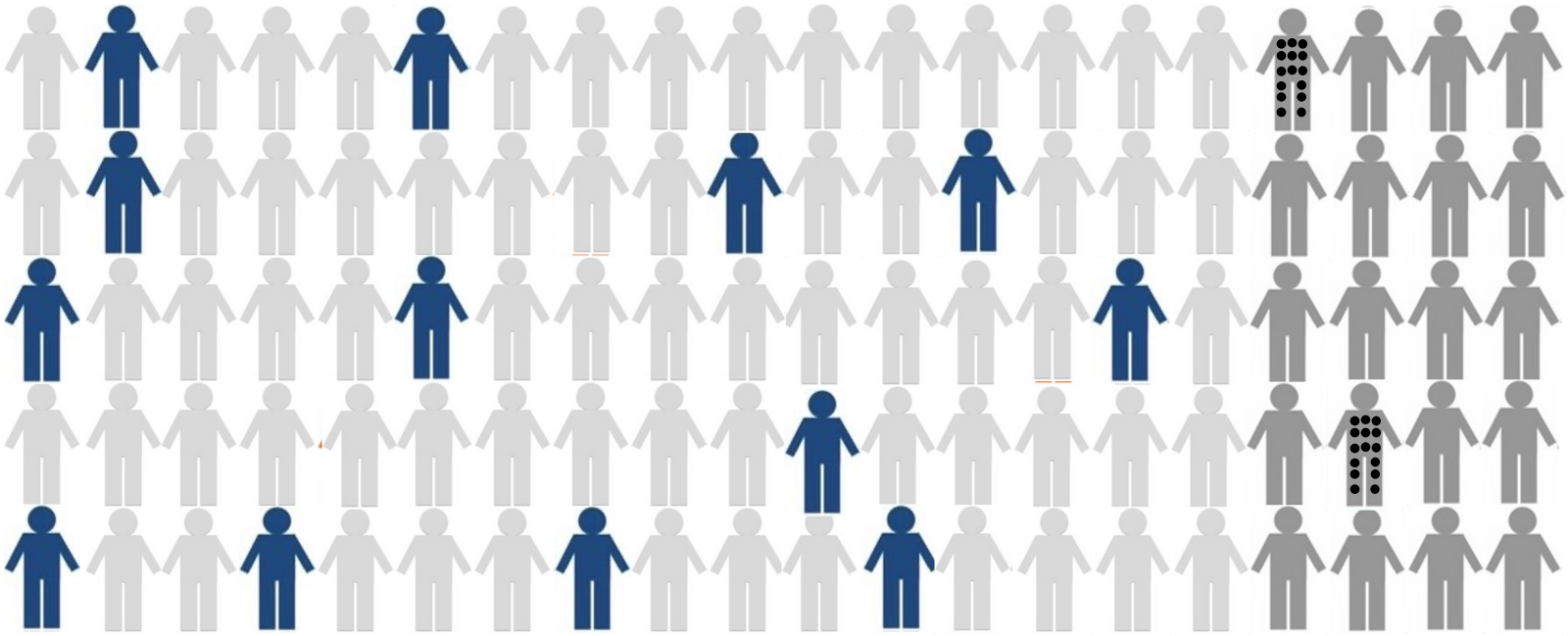
# Scenario 2



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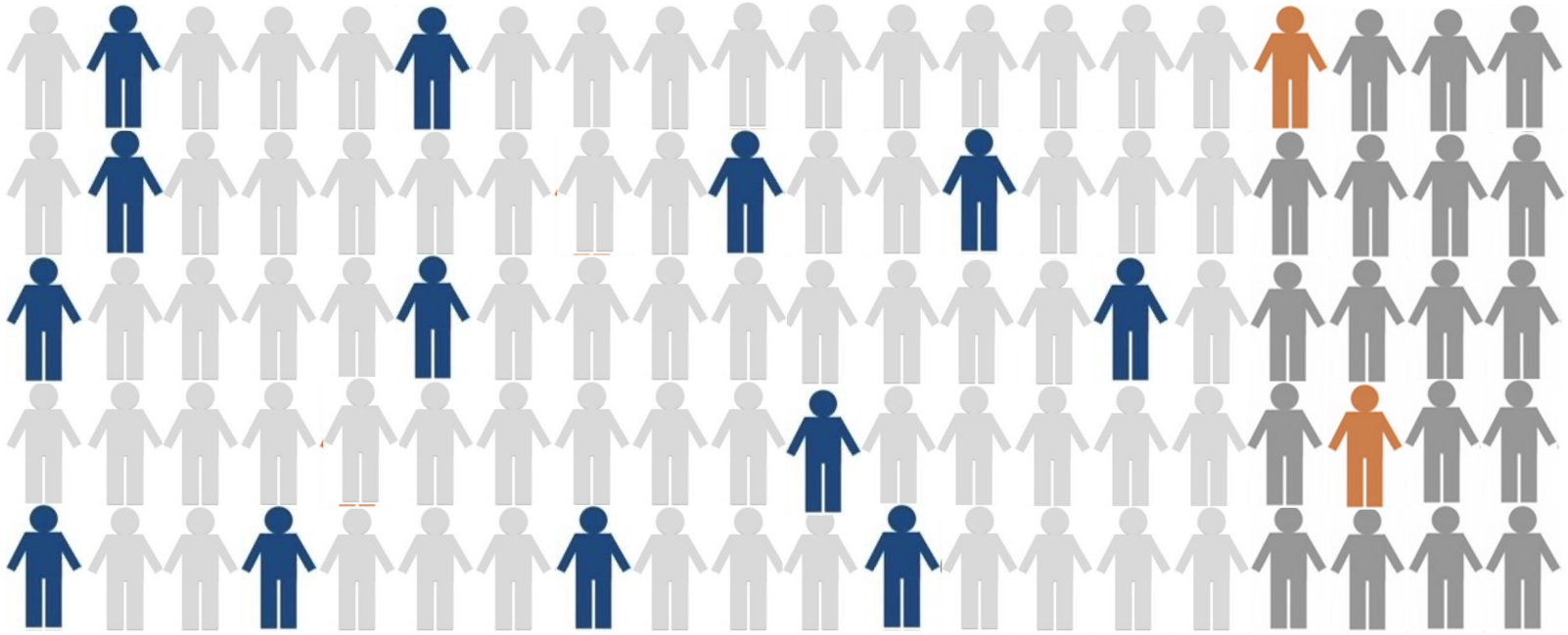
# Scenario 2



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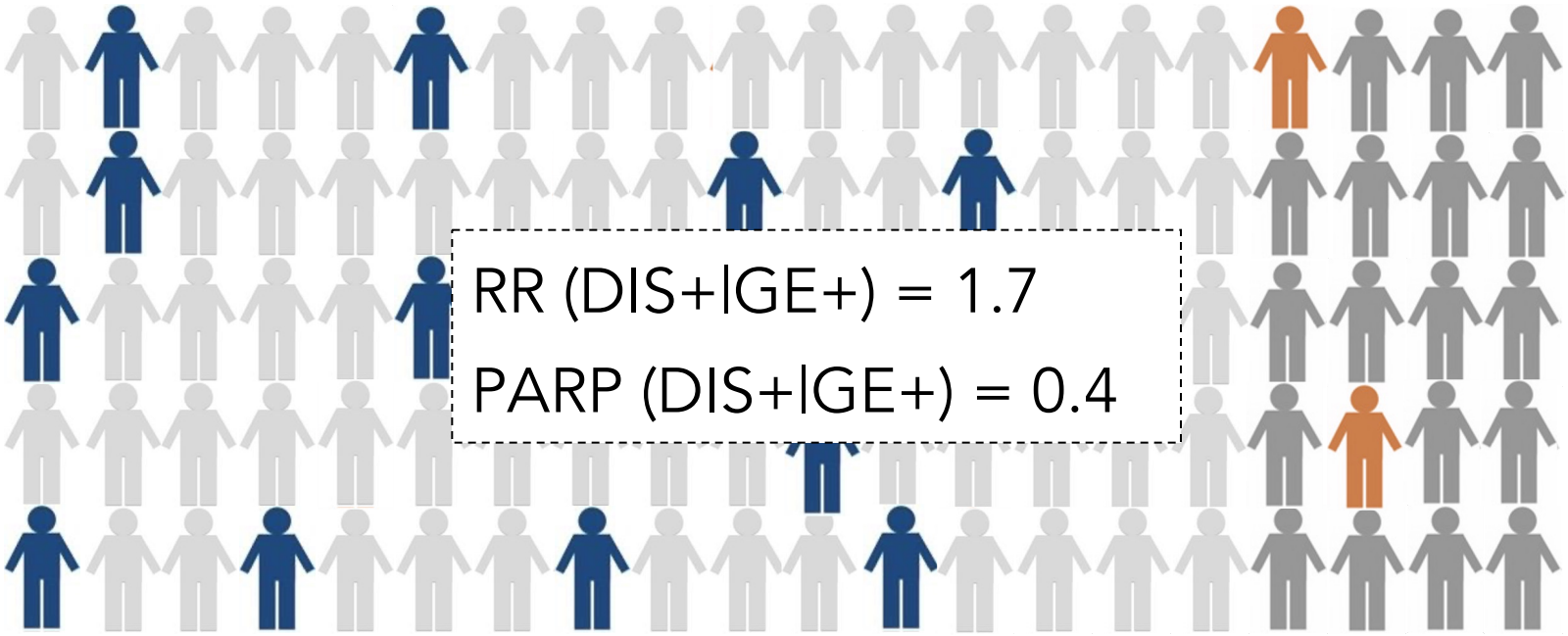



= GE+ = DIS+ = ENV+

Why?

When causes happen together (e.g., gene and environment), what determines how much one of these causes matter is the other factor

Which of course means that we simply cannot ignore the environment within which populations live and within which health happens

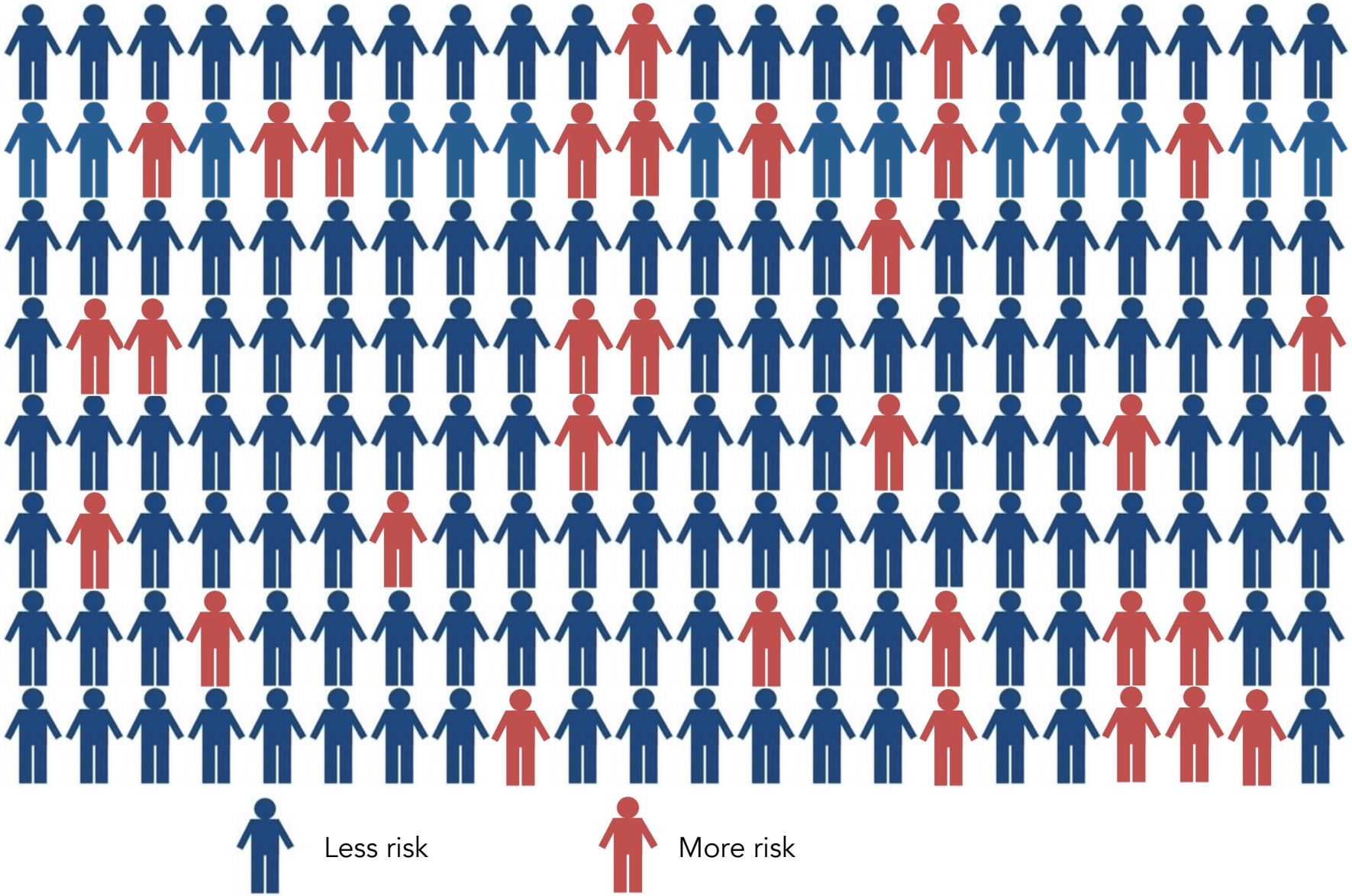
“Genetic variants detected by GWAS typically explain only a fraction of the total family- or twin-based heritability.”

Ormel et al. Translational Psychiatry ( 2019) 9:114 https://doi.org/10.1038/s41398-019-0450-5

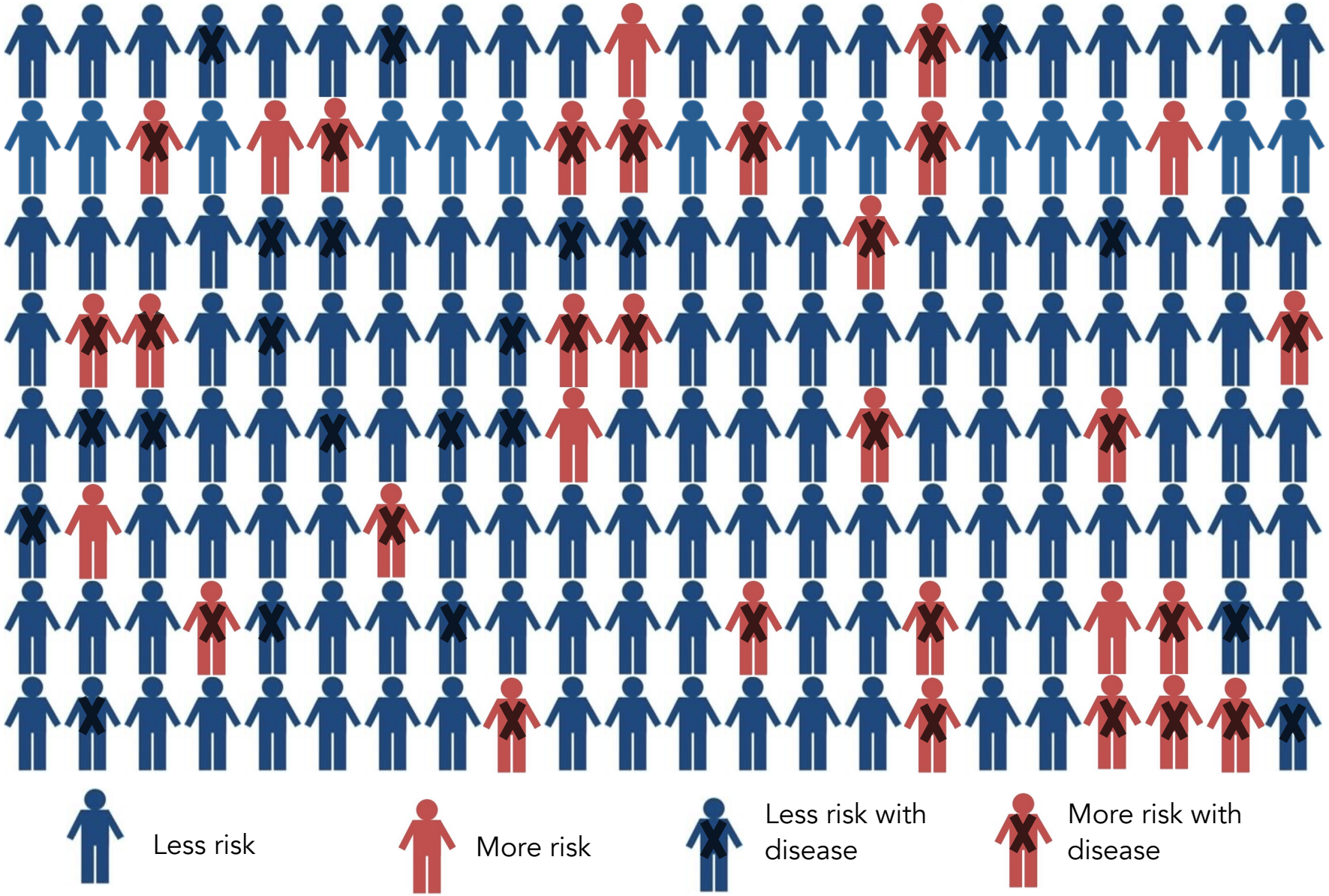
http://36.media.tumblr.com/tumblr_lmampu8hpP1qffl4go1_1280.jpg

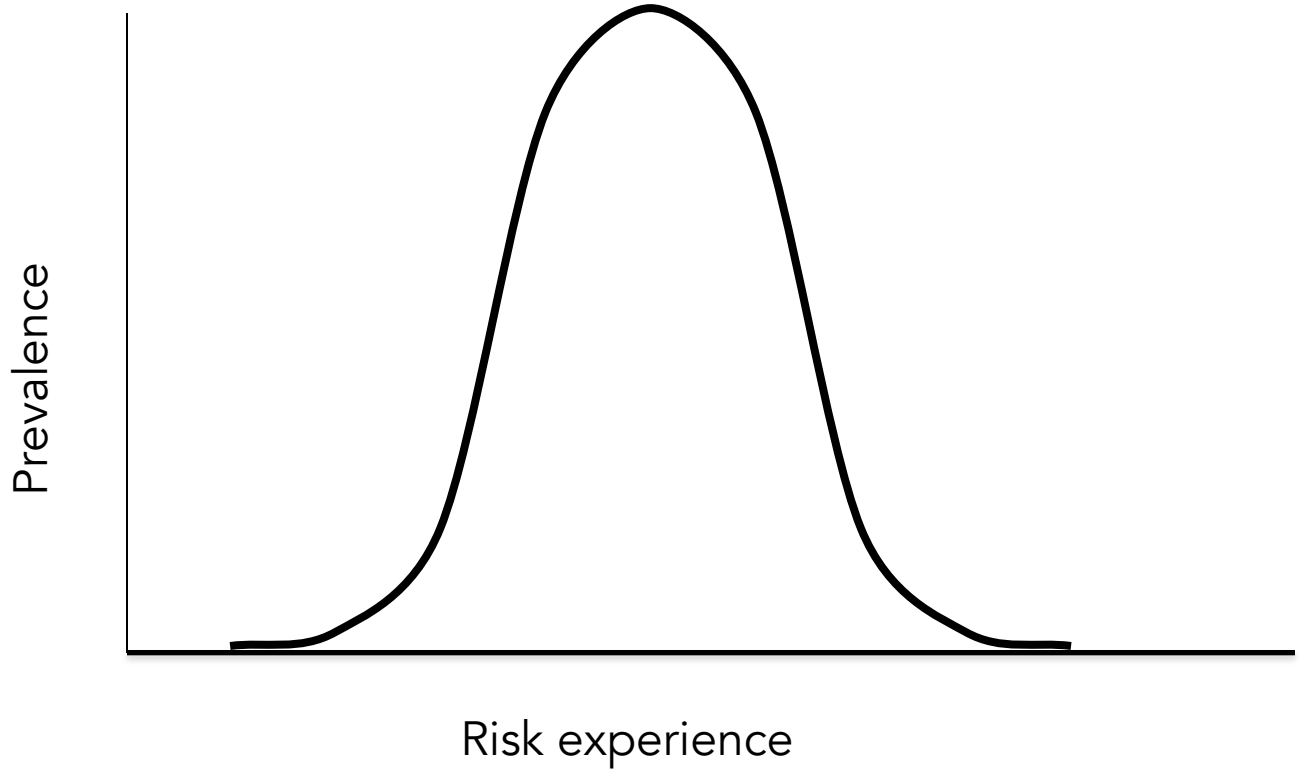
6. What does this mean for interventions?

# Some people are ‘exposed’



# Both exposed and unexposed have disease



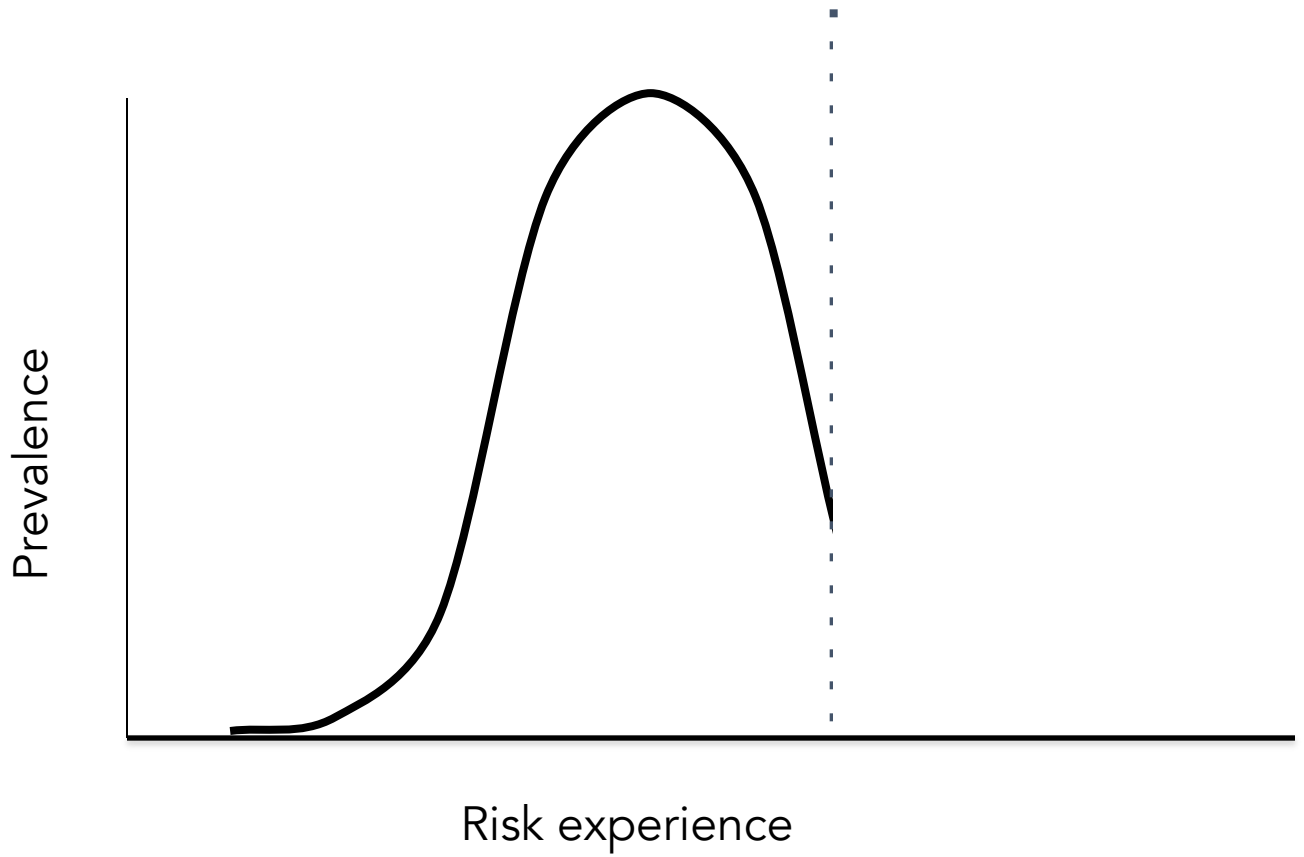



Rose G. The strategy of preventive medicine. Oxford: Oxford University Press; 1992.

# Identify those who are high risk

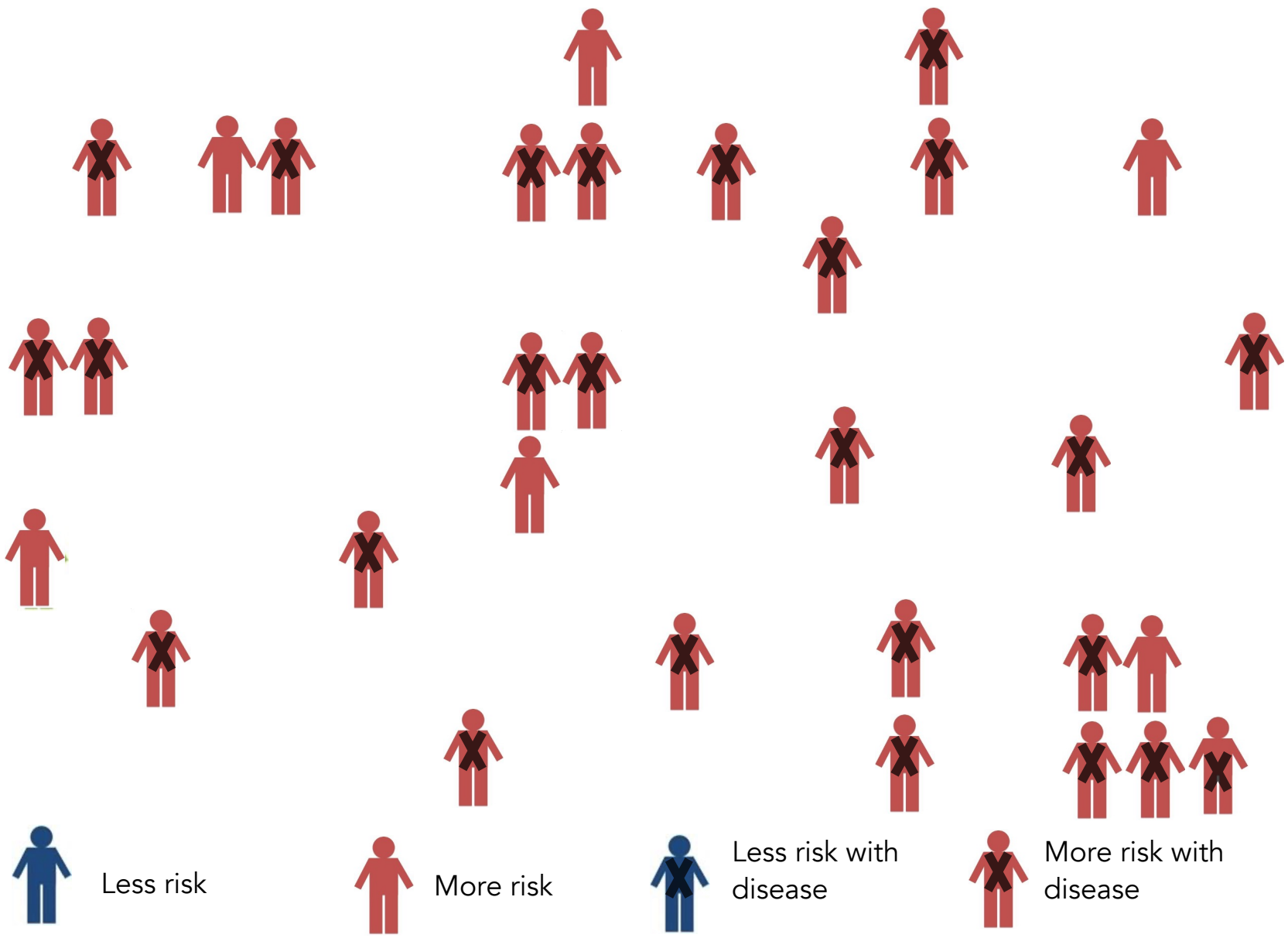

Rose G. The strategy of preventive medicine. Oxford: Oxford University Press; 1992.

# Then decrease their risk

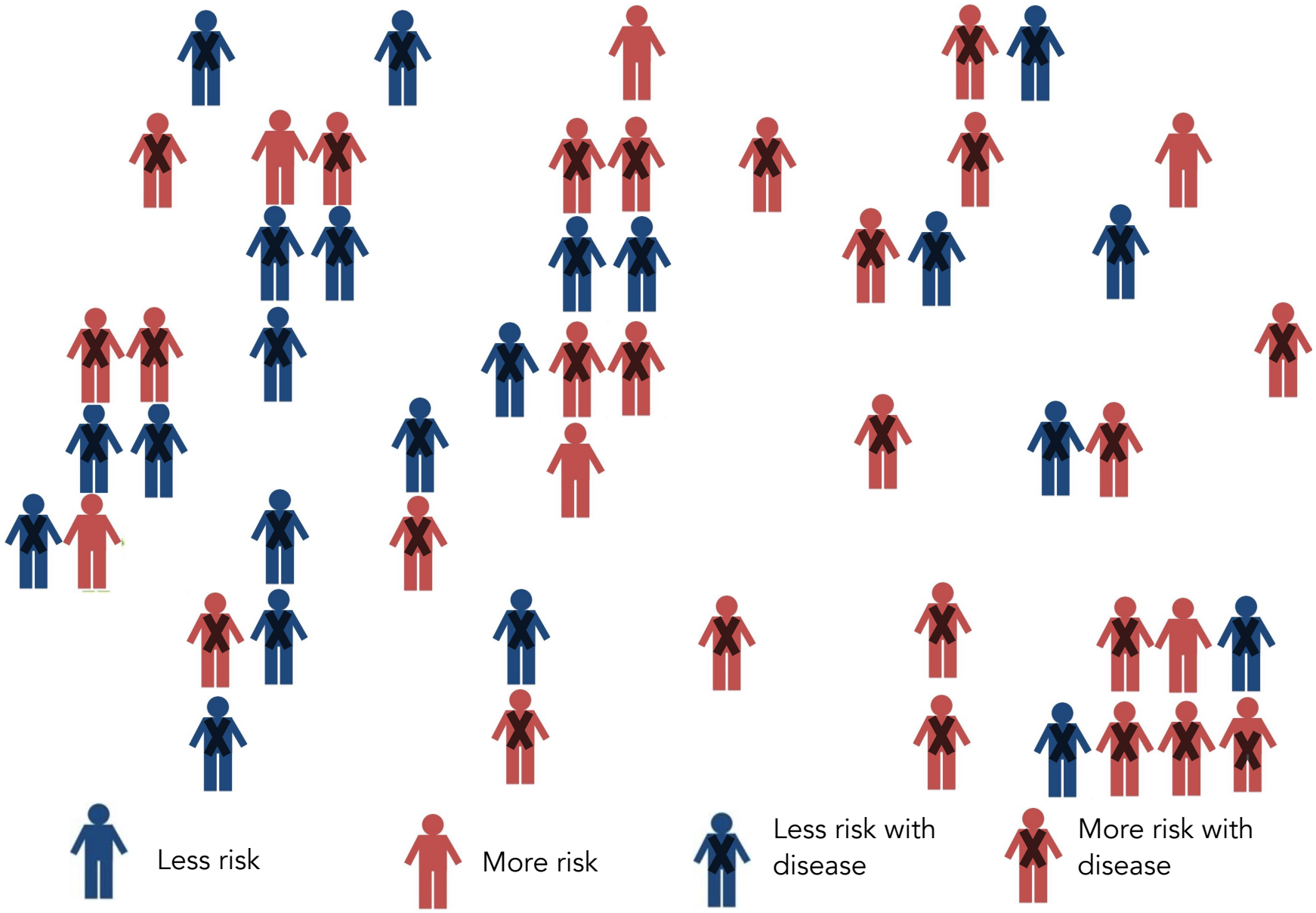



Rose G. The strategy of preventive medicine. Oxford: Oxford University Press; 1992.

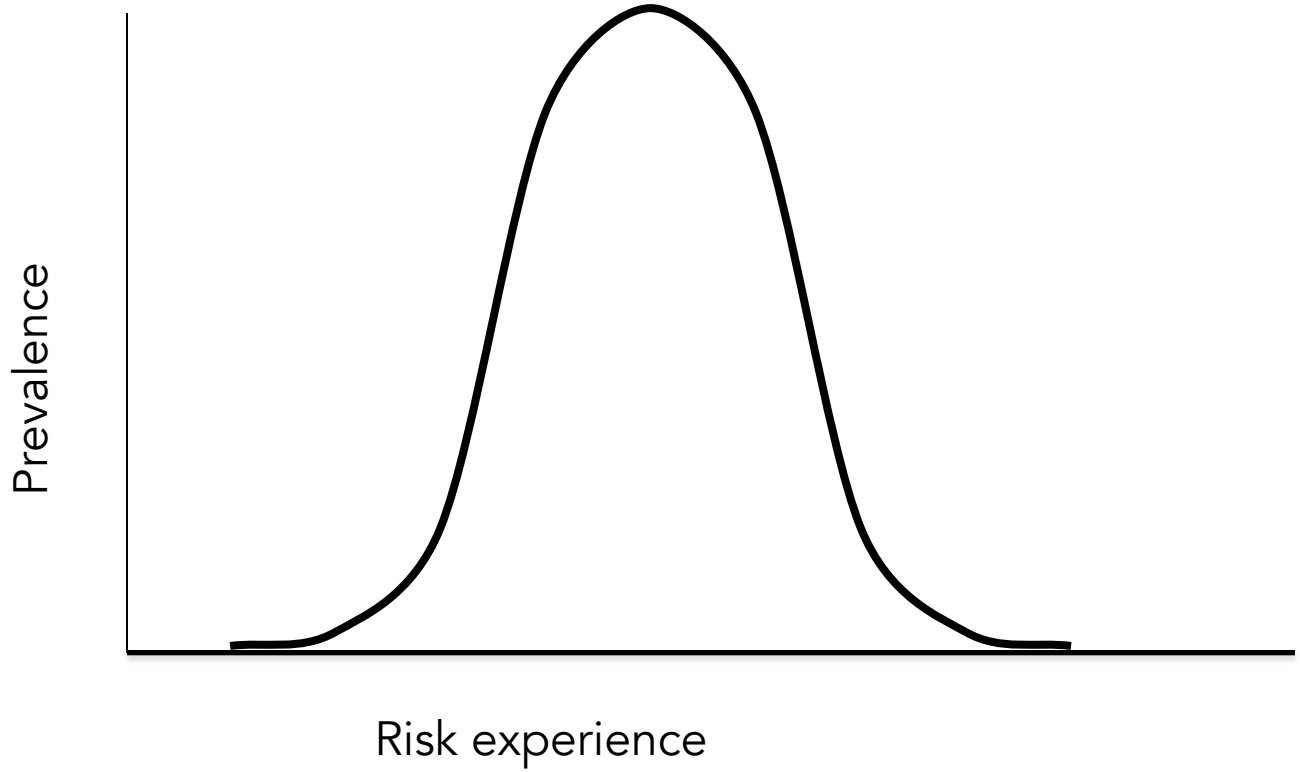
# This strategy sees this



# But misses all of this

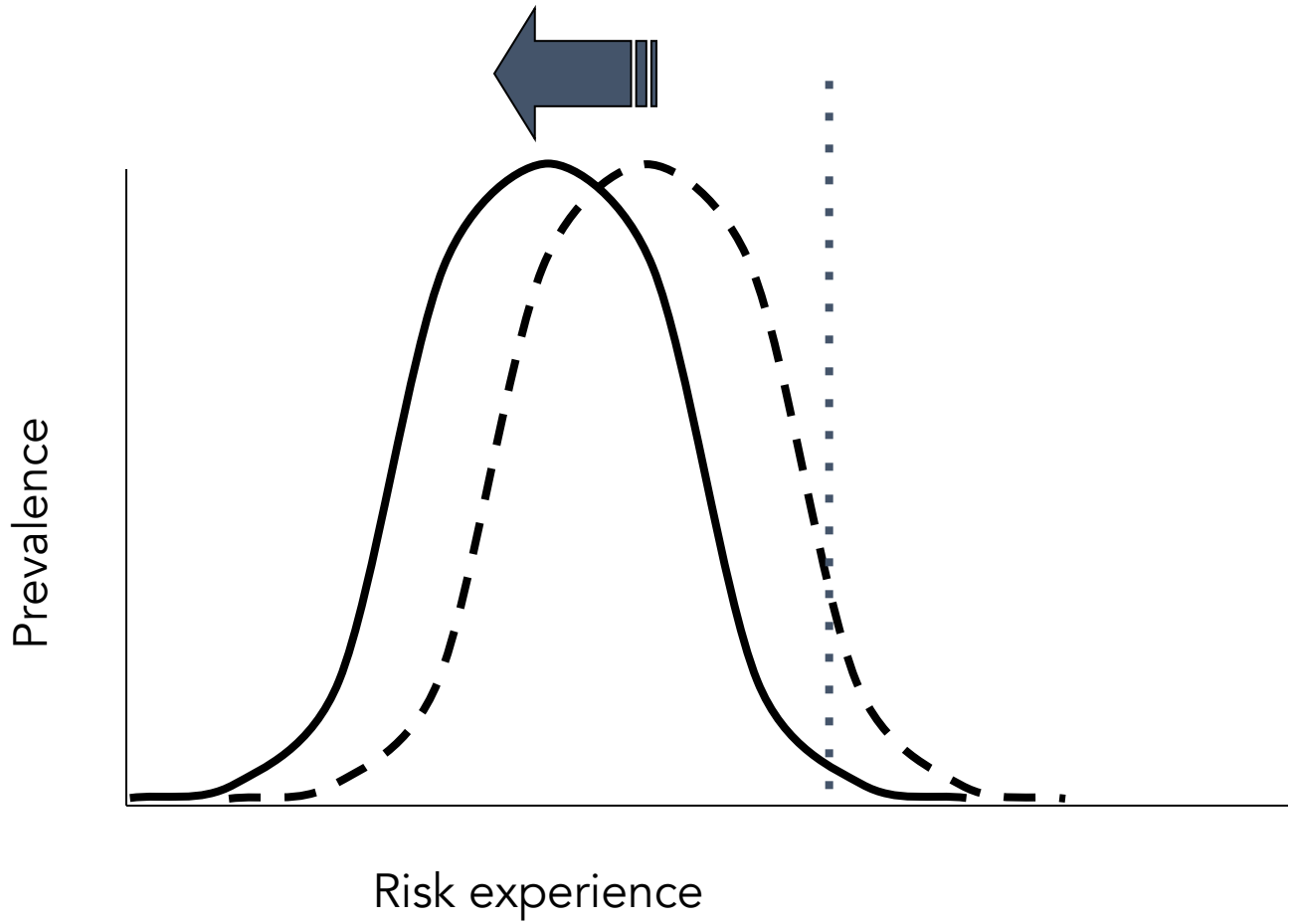


# An alternate, population health, strategy



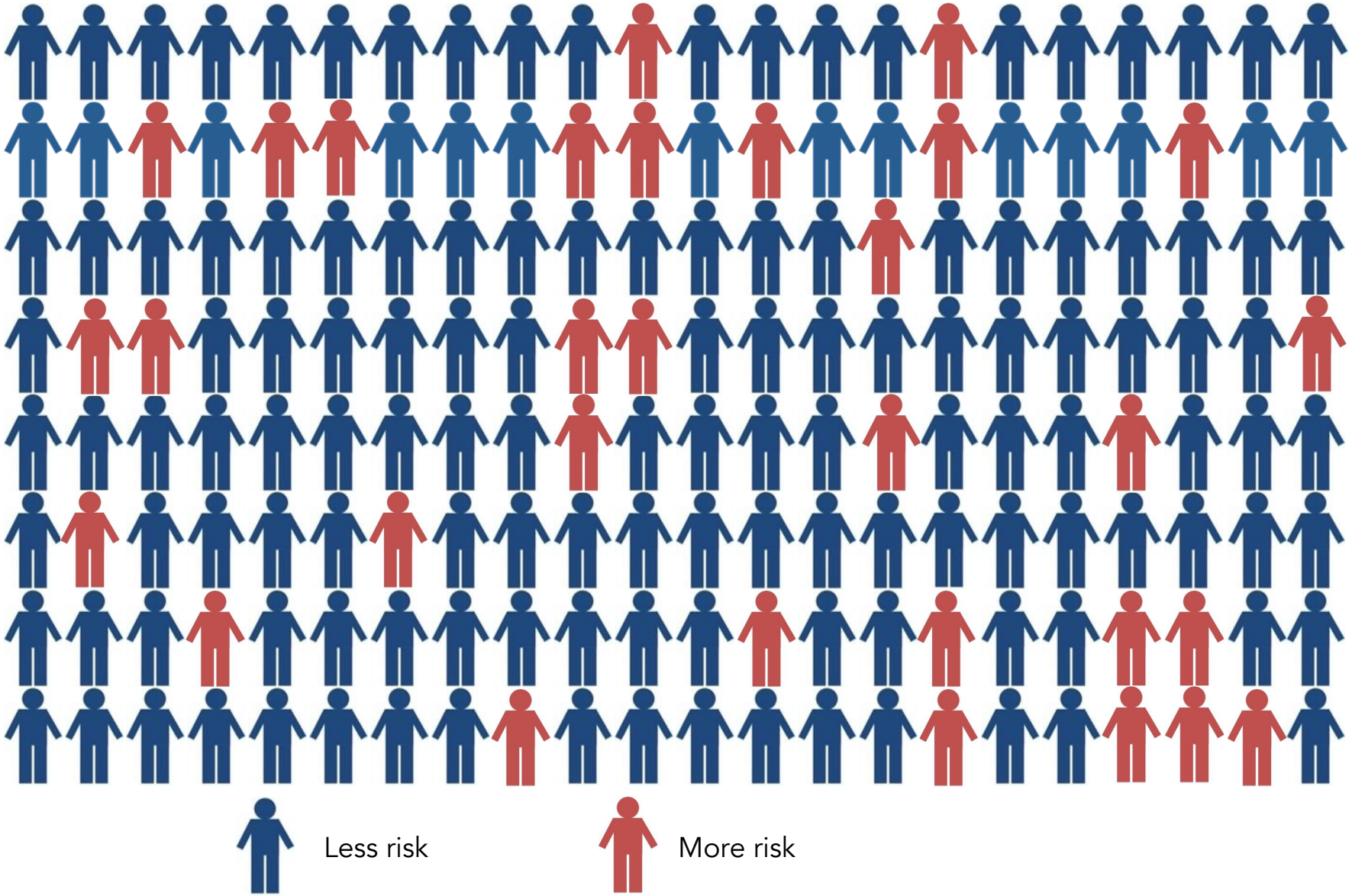

Rose G. The strategy of preventive medicine. Oxford: Oxford University Press; 1992.

# Shifts the entire risk distribution

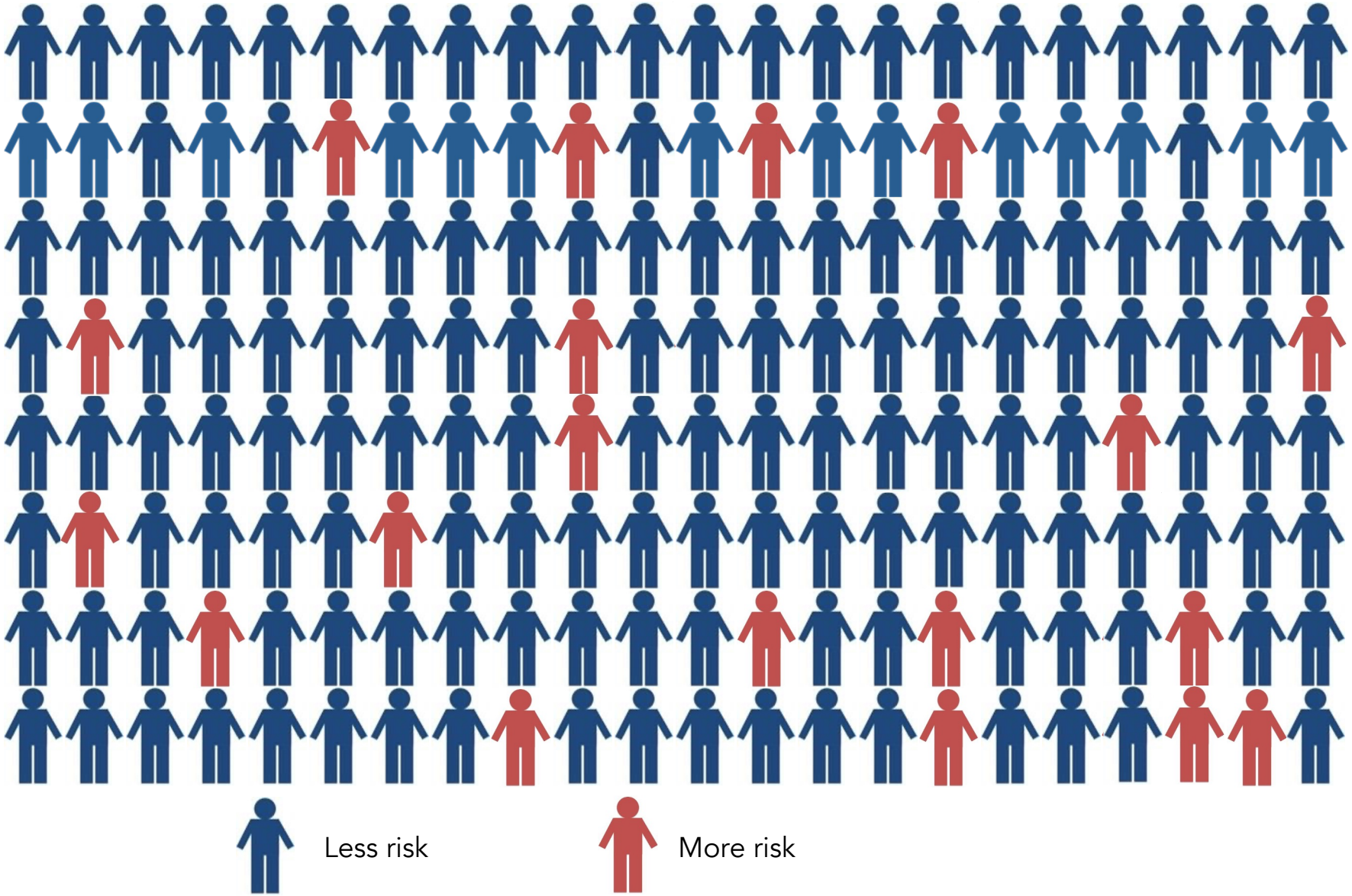



Rose G. The strategy of preventive medicine. Oxford: Oxford University Press; 1992.

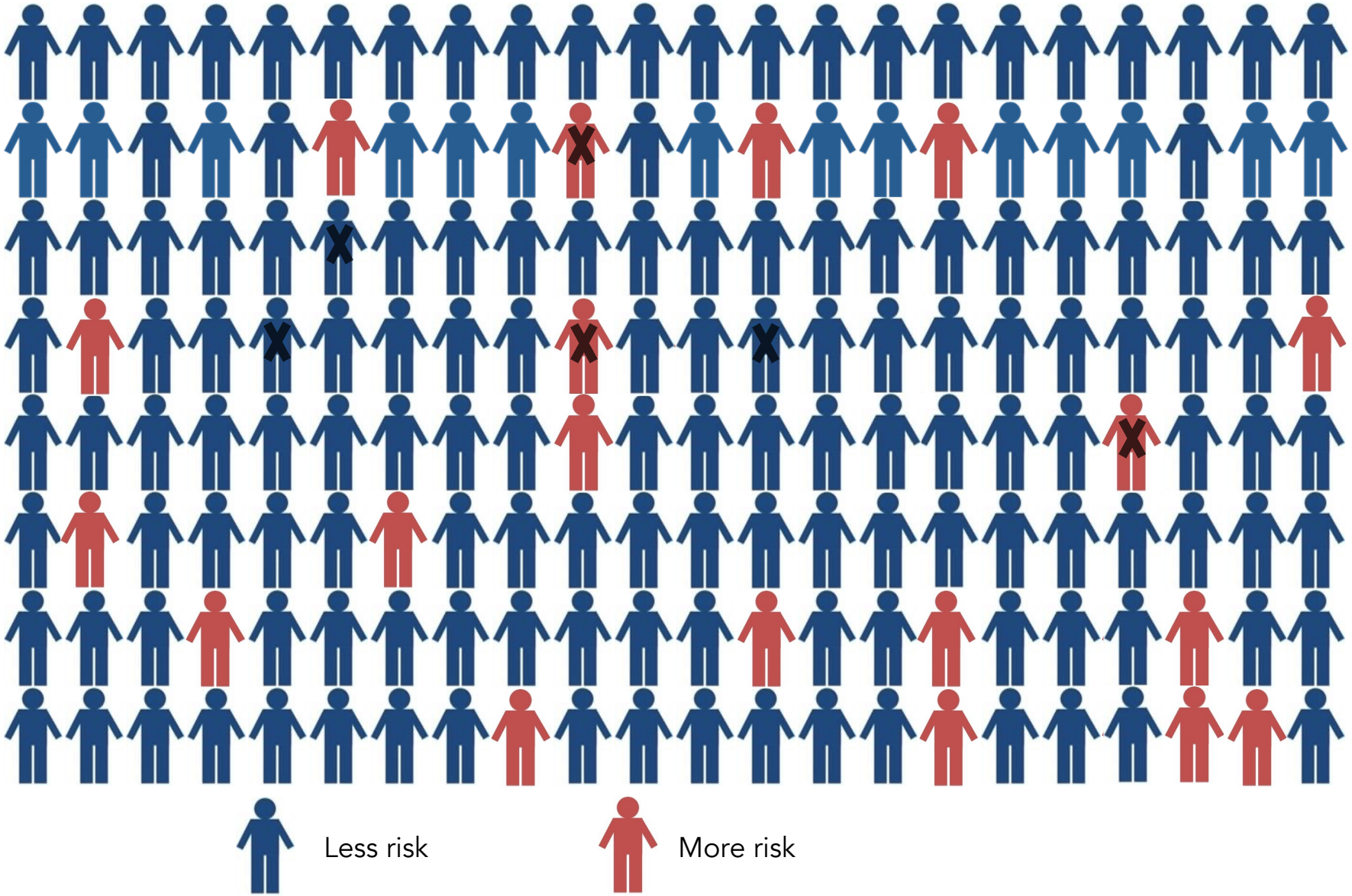
# The population health strategy



# The population health strategy



# The population health strategy



# 7. Two concluding thoughts

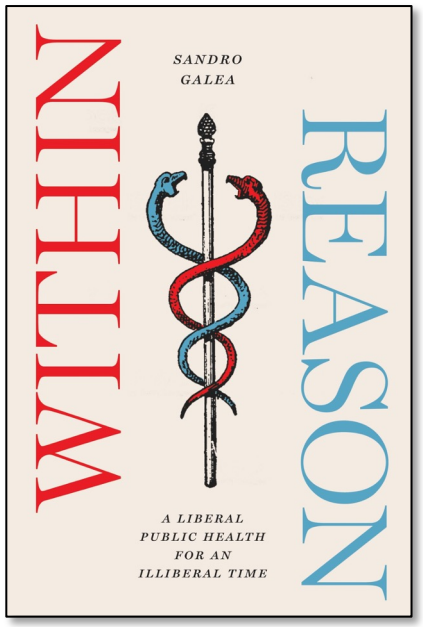

OH, JEFF..
I LOVE
YOU, TOO.
BUT...

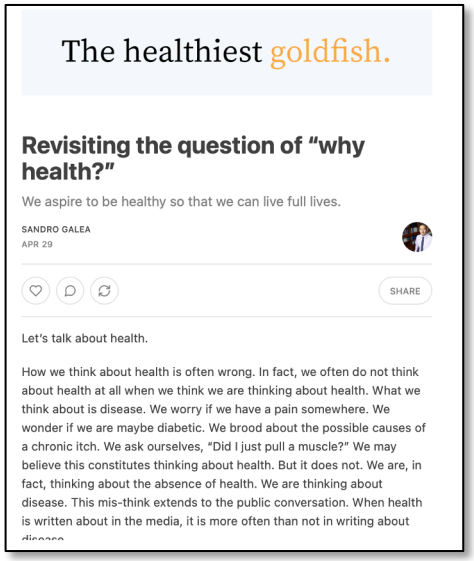
> To effectively prepare to face this public health crisis, health care practitioners and policy makers must commit to addressing the social determinants of health and mental health.

Shim R. Mental health inequities in the context of COVID-19. JAMA Network Open. 2020;3(9):e2020104. doi:10.1001/jamanetworkopen.2020.20104

“Initially it seems silly, then it seems controversial, then it seems progressive, then it seems obvious.”

James Colgrove


WITHIN
REASON
SANDRO
GALEA
A LIBERAL
PUBLIC HEALTH
FOR AN
ILLIBERAL TIME


The healthiest goldfish.
Revisiting the question of "why health?"
We aspire to be healthy so that we can live full lives.
SANDRO GALEA
APR 29
SHARE
Let's talk about health.
How we think about health is often wrong. In fact, we often do not think about health at all when we think we are thinking about health. What we think about is disease. We worry if we have a pain somewhere. We wonder if we are maybe diabetic. We brood about the possible causes of a chronic itch. We ask ourselves, "Did I just pull a muscle?" We may believe this constitutes thinking about health. But it does not. We are, in fact, thinking about the absence of health. We are thinking about disease. This mis-think extends to the public conversation. When health is written about in the media, it is more often than not in writing about