RESEARCH TO ACTION:

Linking Exposome, Brain Health and Health Equity Policy

June 29, 2022
RCCN Workshop: Aging, Race and Health Disparities

Amy Kind, MD, PhD
University of Wisconsin School of Medicine and Public Hea

FUNDING DISCLOSURES

NIH/National Institute on Aging

NIH/National Institute on Minority Health and Health Disparities

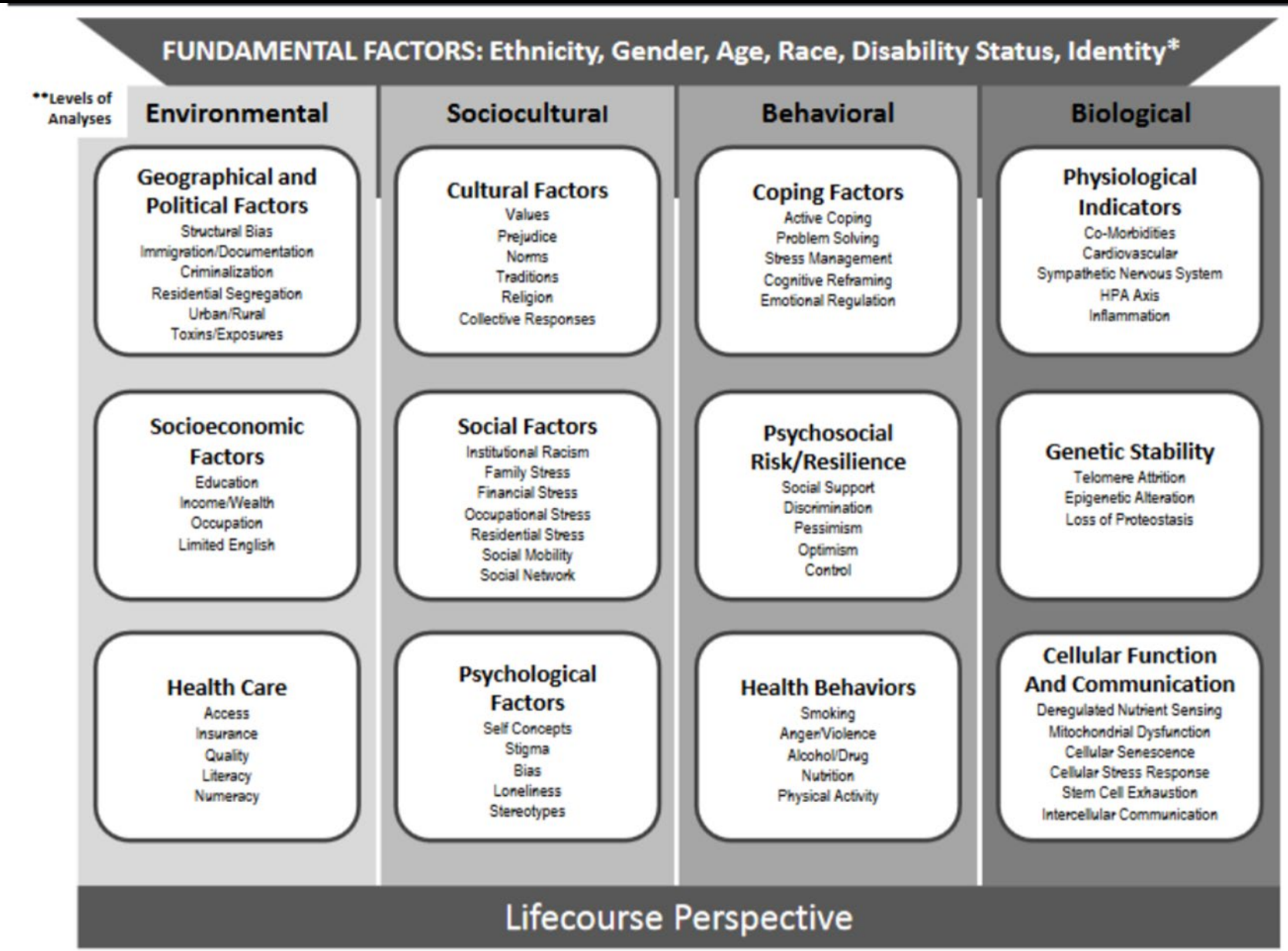
US Department of Veterans Affairs

Amy Kind, MD, PhD
amy.kind@wisc.edu

HEALTH IS NOT DISTRIBUTED EQUALLY

Solutions Needed

NIA MECHANISTIC HEALTH DISPARITIES FRAMEWORK

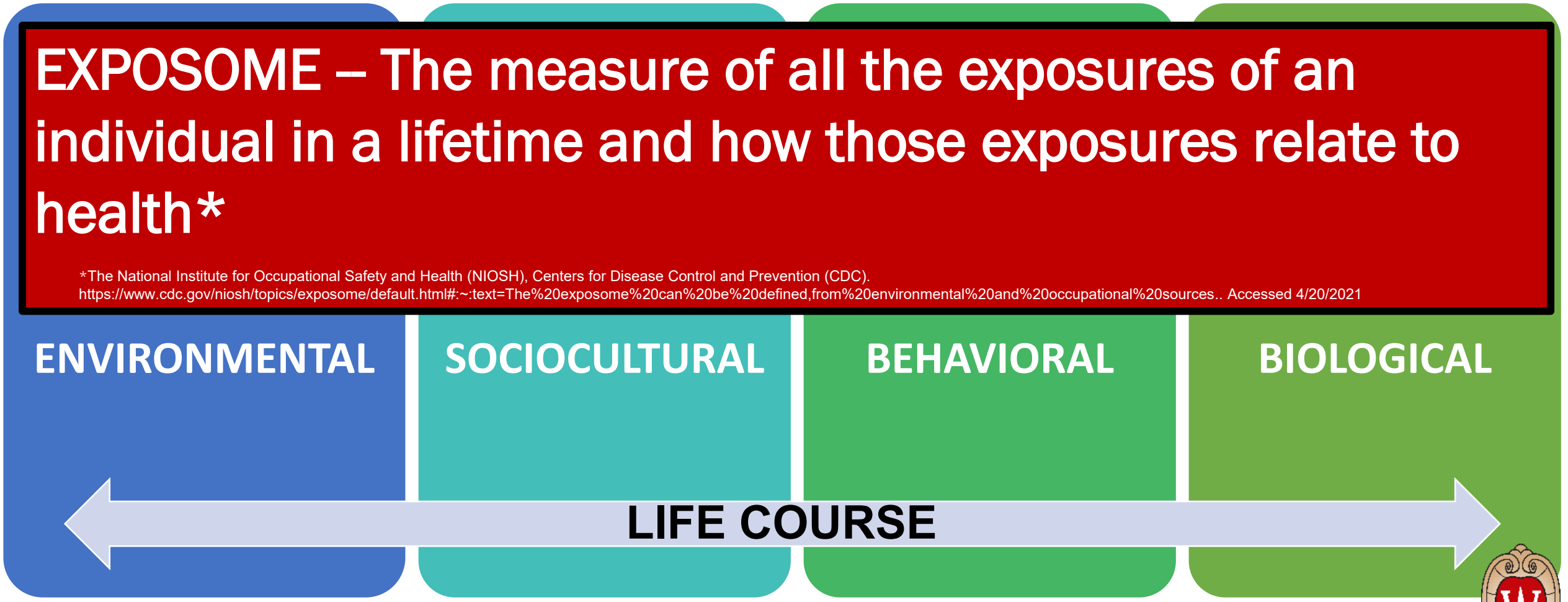


**Hill, Perez-Stable, Anderson and Bernard, *Ethnicity and Disease*, 2015

MECHANISTIC APPROACH

EXPOSOME – The measure of all the exposures of an individual in a lifetime and how those exposures relate to health*

*The National Institute for Occupational Safety and Health (NIOSH), Centers for Disease Control and Prevention (CDC). https://www.cdc.gov/niosh/topics/exposome/default.html#:~:text=The%20exposome%20can%20be%20defined,from%20environmental%20and%20occupational%20sources.. Accessed 4/20/2021



**Hill, Perez-Stable, Anderson and Bernard, *Ethnicity and Disease*, 2015

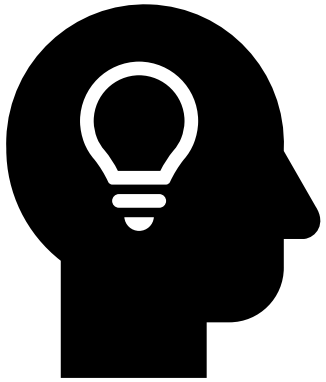
HEALTH IS NOT DISTRIBUTED EQUALLY

POWER OF POLICY

“Policies are fundamentally linked to health promotion and disease prevention. They create opportunities for broad and sustainable improvements in population health….

~Eyler and Bownson, *“The Power of Policy to Improve Health”*, Institute of Medicine 2012

POLICY ACTIONABLE METRICS ARE…

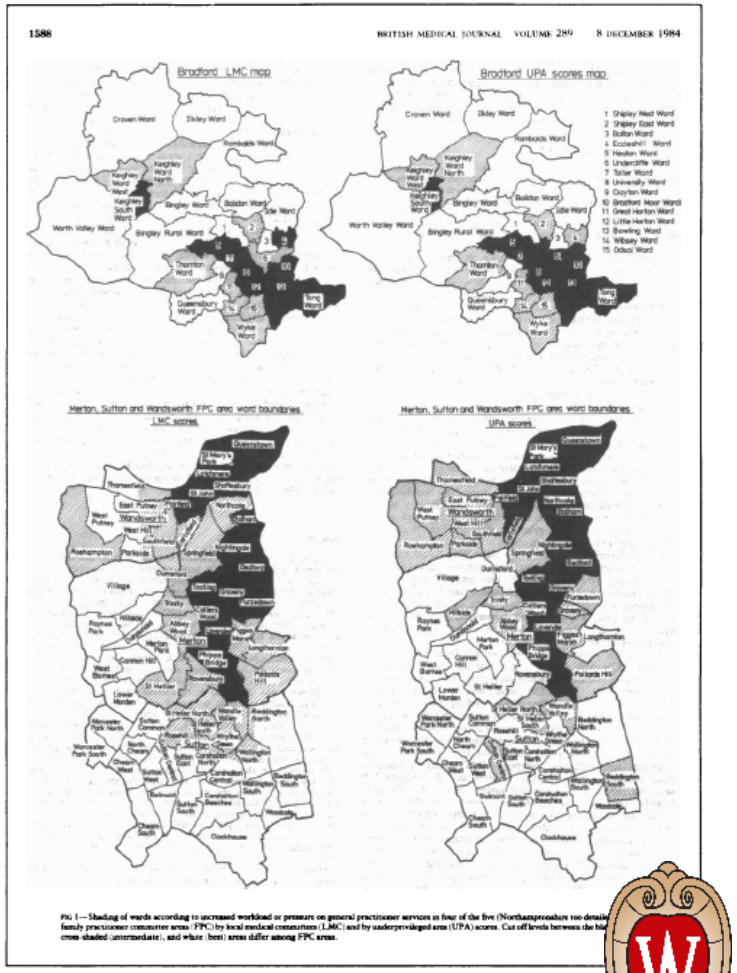


1. Inclusive of all targeted persons in a political unit (generalizable)
2. Regularly updated (timely)
3. Rigorously tested (valid)
4. Accessible to all (open)
5. Constructed to meet the needs of a range of possible users (understandable)

*Kind et al, NEJM 2018

METRICS OF NEIGHBORHOOD DISADVANTAGE

- **Quantifiable**
  - Social determinants of health in a discrete population-sensitive area (typically 500-1500 persons)
- **Robust**
  - Harmonizable
  - Privacy-compliant
- **Actionable**
  - Outreach
  - Resource targeting



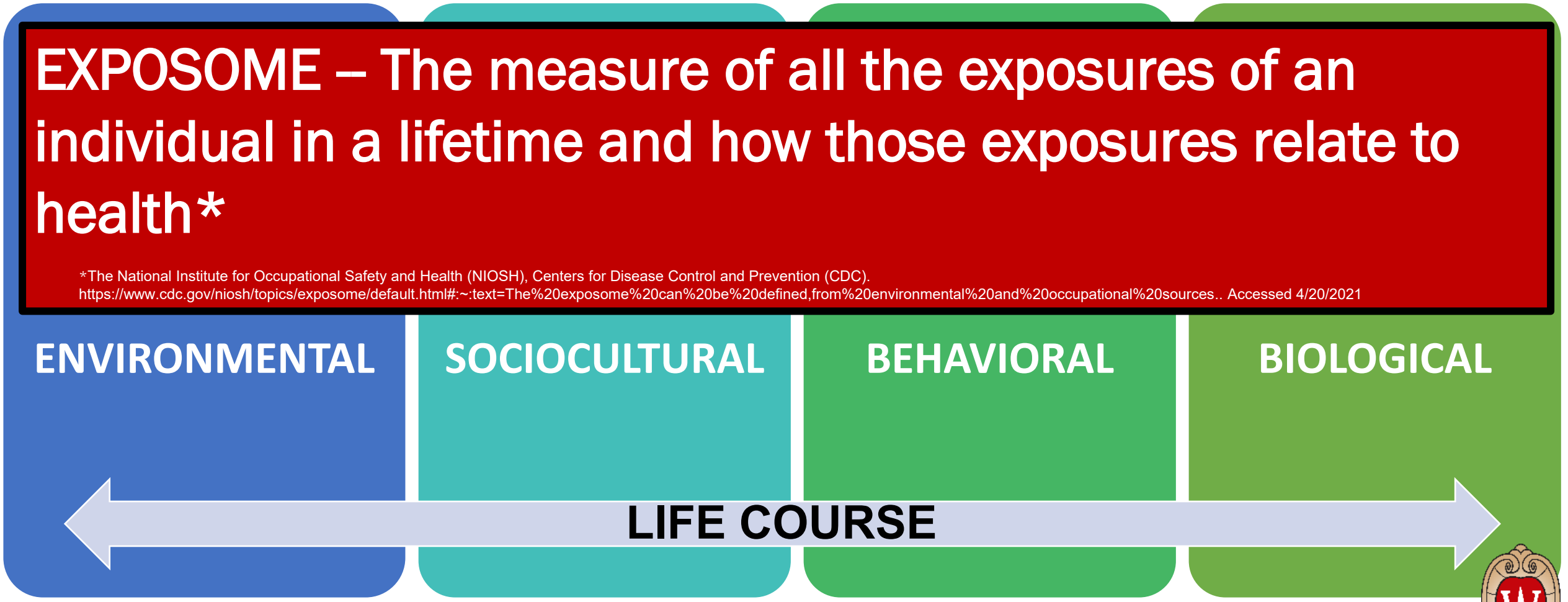
The Jarman Index

* Jarman et al, BMJ 1983

MECHANISTIC APPROACH

EXPOSOME – The measure of all the exposures of an individual in a lifetime and how those exposures relate to health*

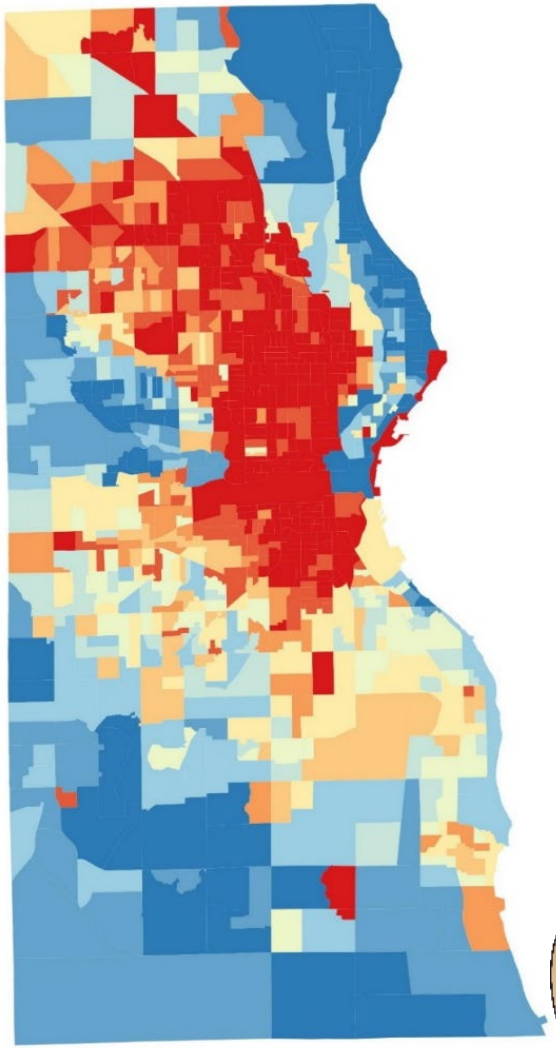
*The National Institute for Occupational Safety and Health (NIOSH), Centers for Disease Control and Prevention (CDC). https://www.cdc.gov/niosh/topics/exposome/default.html#:~:text=The%20exposome%20can%20be%20defined,from%20environmental%20and%20occupational%20sources.. Accessed 4/20/2021



**Hill, Perez-Stable, Anderson and Bernard, *Ethnicity and Disease*, 2015

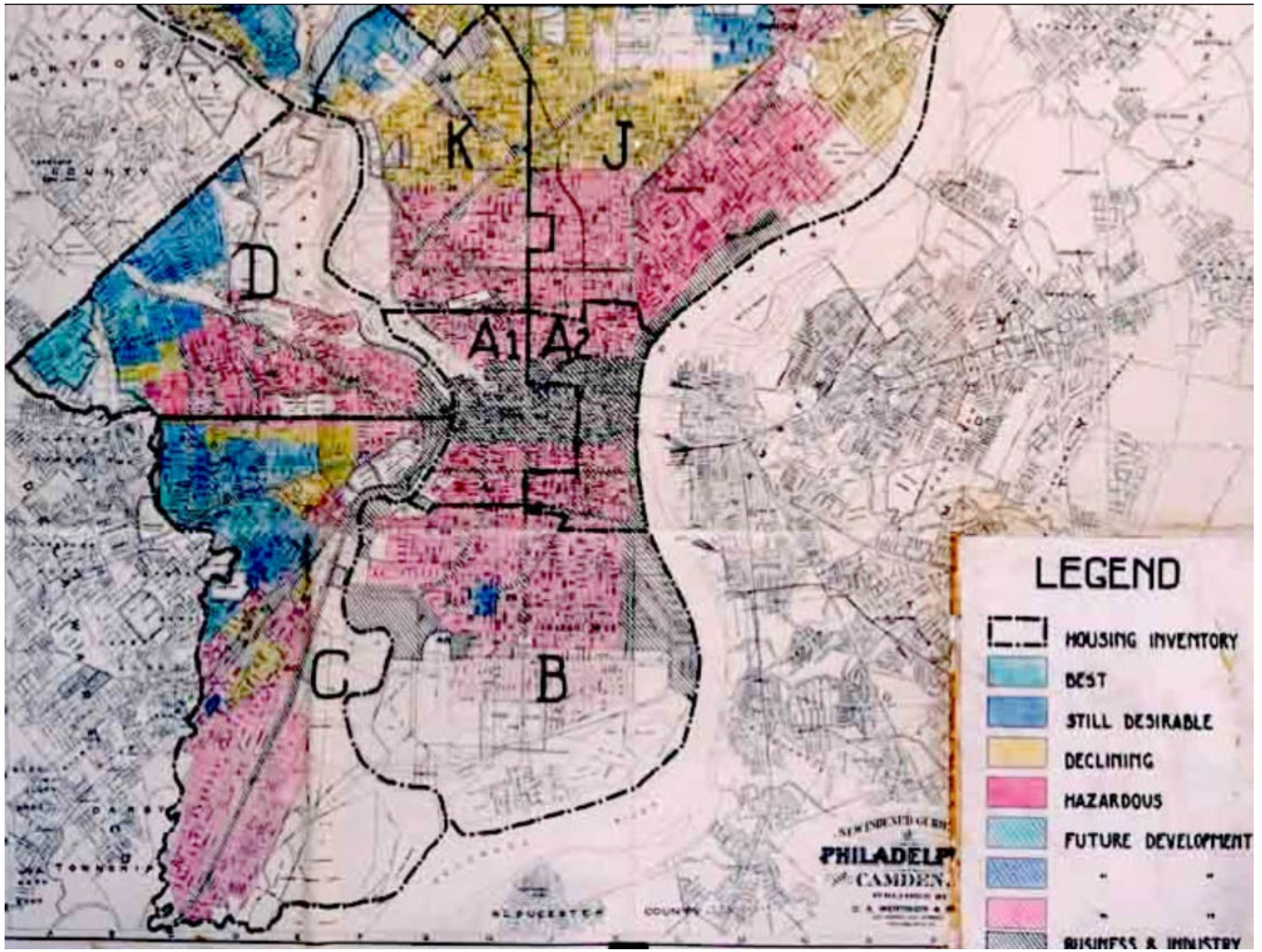
AREA DEPRIVATION INDEX (ADI)

- Originally created by Health Resources and Services Administration in 1990s and employed at the county level
- **Education, employment, housing-quality and poverty**
- UW team updated
  - Data sources
  - Refined down to census block-group level (i.e. “neighborhood” ~ 1,500 persons)
- ADI measures available for full US including DC and PR



Milwaukee County

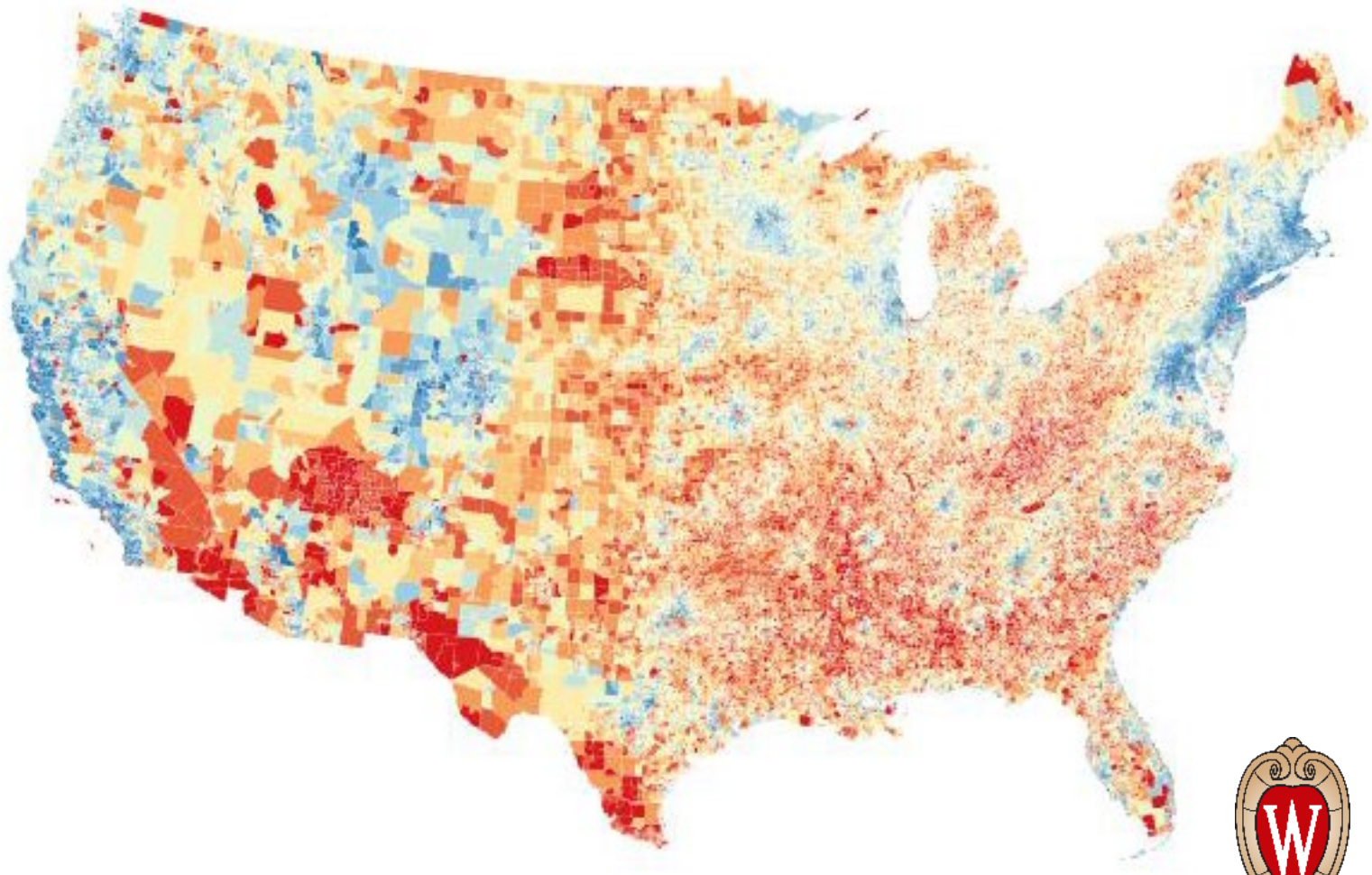
STRUCTURAL INEQUITIES



*The HOLC maps are part of the records of the FHLBB (RG195) at the National Archives II Archived 2016-10-11 at the Wayback Machine.

CHARACTERISTICS OF HIGHLY DISADVANTAGED NEIGHBORHOODS IN US

- More often in **urban core** and **rural** areas



*Kind et al, *Annals of Internal Medicine*, 2014; Kind and Buckingham, *New England Journal of Medicine,* 2018

TOP THREE CONSIDERATIONS FOR USING MULTIDOMAIN INDICES OF DISADVANTAGE (LIKE THE ADI)

1. Individual-level SES and contextual-level SES are not equal
2. Associations are typically non-linear
3. Application and interpretation must be informed by health disparities theory

JAMA Network | Open

Original Investigation | Surgery

Analysis of Delayed Surgical Treatment and Oncologic Outcomes in Clinical Stage I Non–Small Cell Lung Cancer

Brendan T. Heiden, MD; Daniel B. Eaton Jr, MPH; Kathryn E. Engelhardt, MD, MS; Su-Hsin Chang, PhD, SM; Yan Yan, MD, PhD; Mayank R. Patel, MD; Daniel Kreisel, MD, PhD; Ruben G. Nava, MD; Bryan F. Meyers, MD, MPH; Benjamin D. Kozower, MD, MPH; Varun Puri, MD, MSCI

nd, Roee Gutman, Kristina Monteiro, William R. Buckingham,

DOI: 10.1377/hlthaff.2017.1509
HEALTH AFFAIRS 37,
NO. 7 (2018): –

Rachel Marsh[1] a

Area Deprivation Index Predicts Readmission Risk at an Urban Teaching Hospital

American Journal of Transplantation | AST American Society of Transplantation | ASTS

ORIGINAL ARTICLE

Neighborhood socioeconomic deprivation is associated with worse patient and graft survival following pediatric liver transplantation

Sharad I. Wadhwani, Andrew F. Beck, John Bucuvalas, Laura Gottlieb, Uma Kotagal, Jennifer C. Lai

nuary 2020 | https://doi.org/10.1111/ajt.15786 | Citations: 4

SPECIAL ISSUE: HEA

Neighborhood

JAMA Cardiology | Original Investigation

Association of Socioeconomic Disadvantage With Long-term Mortality After Myocardial Infarction
The Mass General Brigham YOUNG-MI Registry

Adam N. Berman, MD; David W. Biery, AB; Curtis Ginder, MD; Avinainder Singh, MBBS, MMSc; Jonggyu Baek, PhD; Rishi K. Wadhera, MD, MPP, MPhil; Wanda Y. Wu, BA; Sanjay Divakaran, MD; Ersilia M. DeFilippis, MD; Jon Hainer, BS; Christopher P. Cannon, MD; Jorge Plutzky, MD; Donna M. Polk, MD, MPH; Khurram Nasir, MD, MPH; Marcelo F. Di Carli, MD; Arlene S. Ash, PhD; Deepak L. Bhatt, MD, MPH; Ron Blankstein, MD

Annals

LATEST ISSUES

‹ PREV ARTICLE | THIS ISS

ORIGINAL RESEARCH

Safety-Net Hospitals, Under Maryland's All-

Stephen F. Jencks, MD, MPH; Alyson Schu
MSPH; Amy J.H. Kind, MD, PhD

Article, Author, and Disclosure Inform

ELSEVIER

Developme Neur

Volume 45, O

gnitive e

100811

Brain connectivity and socioeconomic status at birth and externalizing symptoms at age 2 years

Bruce Ramphal [a], Diana J. Whalen [b], Jeanette K. Kenley [c], Qiongru Yu [b], Christopher D. Smyser [c, d, e], Cynthia E. Rogers [b, e], Chad M. Sylvester [b]

JAMA Network | Open

Original Investigation | Infectious Diseases

Racial Disparities in Incidence and Outcomes Among Patients With COVID-19

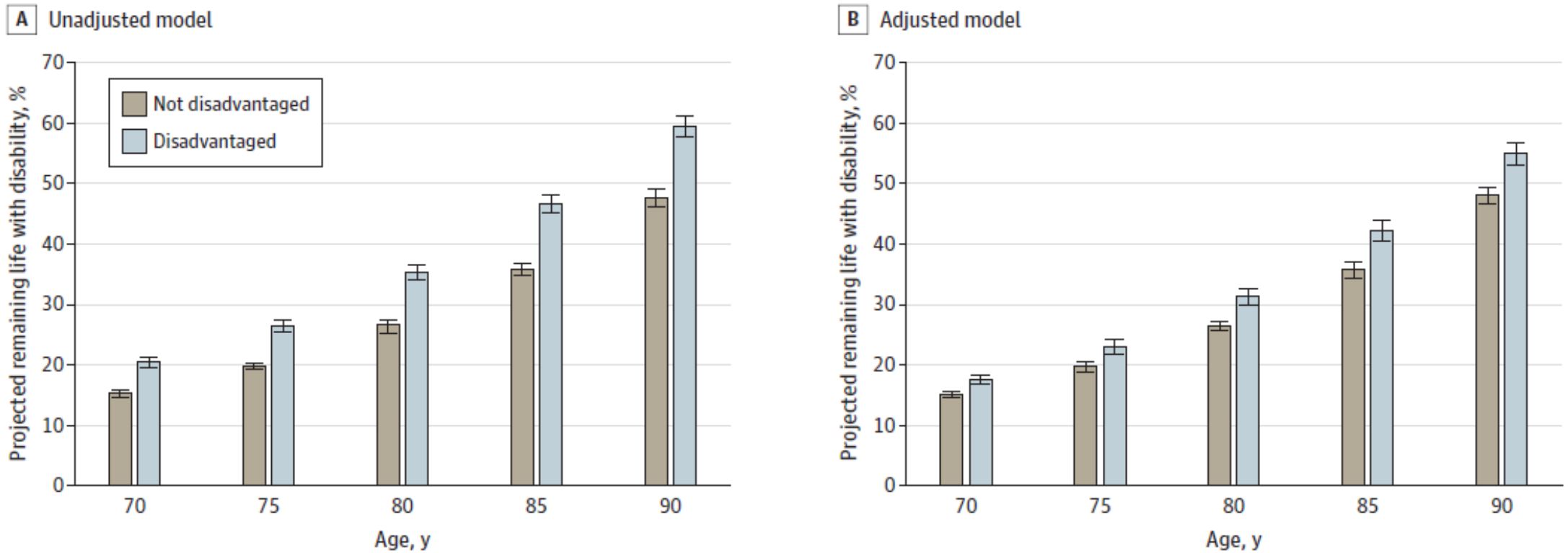
L. Silvia Muñoz-Price, MD, PhD; Ann B. Nattinger, MD, MPH; Frida Rivera, MD, PhD; Ryan Hanson, MS; Cameron G. Gmehlin, BA; Adriana Perez, MS; Siddhartha Singh, MD, MS, MBA; Blake W. Buchan, PhD; Nathan A. Ledeboer, PhD; Liliana E. Pezzin, PhD, JD

JAMA Internal Medicine | Original Investigation

Association Between Neighborhood Disadvantage and Functional Well-being in Community-Living Older Persons

Thomas M. Gill, MD; Emma X. Zang, PhD; Terrence E. Murphy, PhD; Linda Leo-Summers, MPH; Evelyne A. Gahbauer, MD, MPH; Natalia Festa, MD, MBA; Jason R. Falvey, DPT, PhD; Ling Han, MD, PhD

Figure 2. Percentage of Projected Remaining Life With Disability According to Age and Neighborhood Disadvantage



JOURNAL OF THE AMERICAN GERIATRICS SOCIETY

Clinical Investigation | Full Access

Neighborhood-Level Social Disadvantage and Risk of Delirium Following Major Surgery

Franchesca Arias PhD, Fan Chen MS, MPH, Tamara G. Fong MD, PhD, Haley Shiff BA, Margarita Alegria PhD, Edward R. Marcantonio MD, SM, Yun Gou MA, Richard N. Jones ScD ... See all authors

First published: 31 August 2020 | https://doi.org/10.1111/jgs.16782

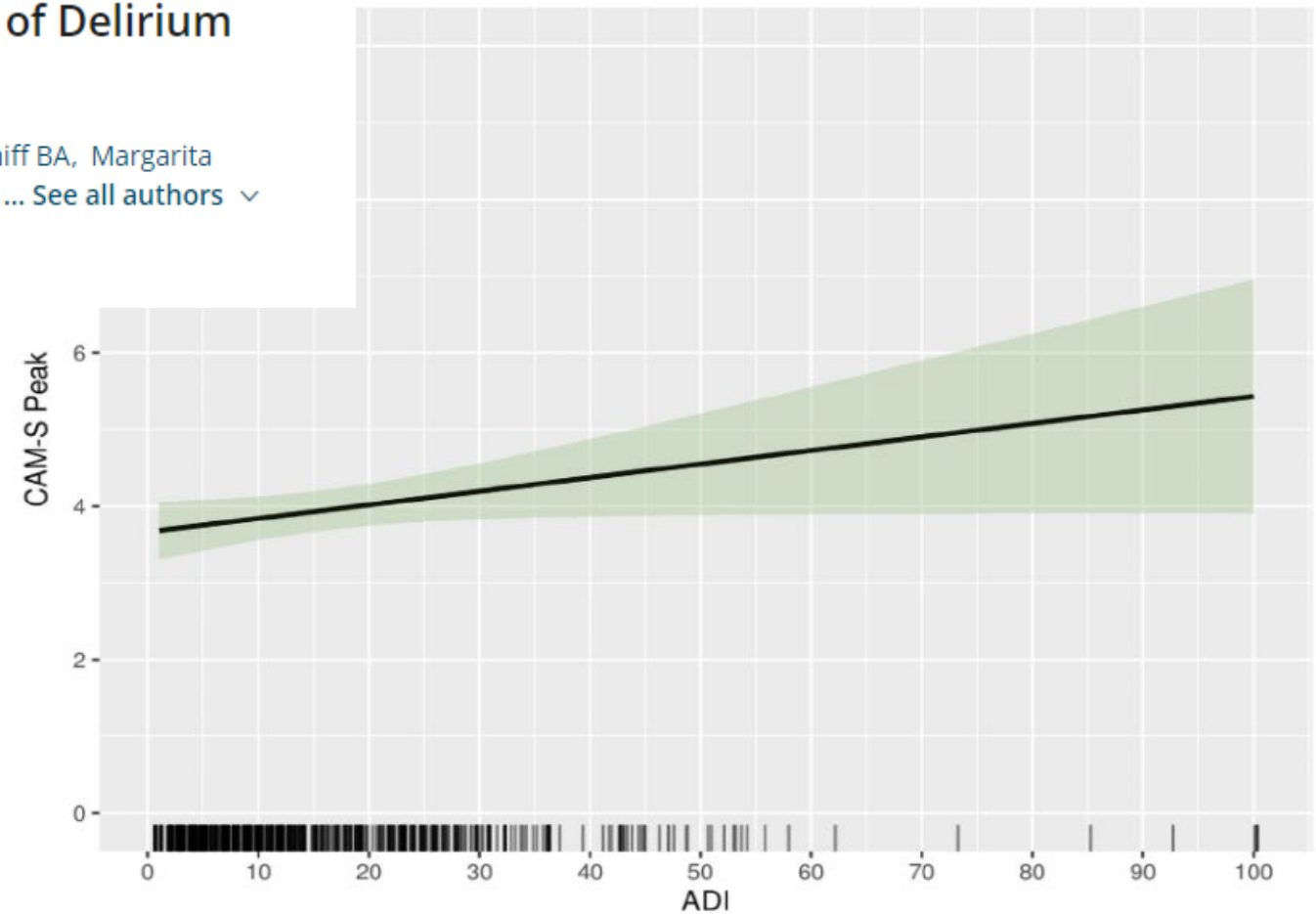
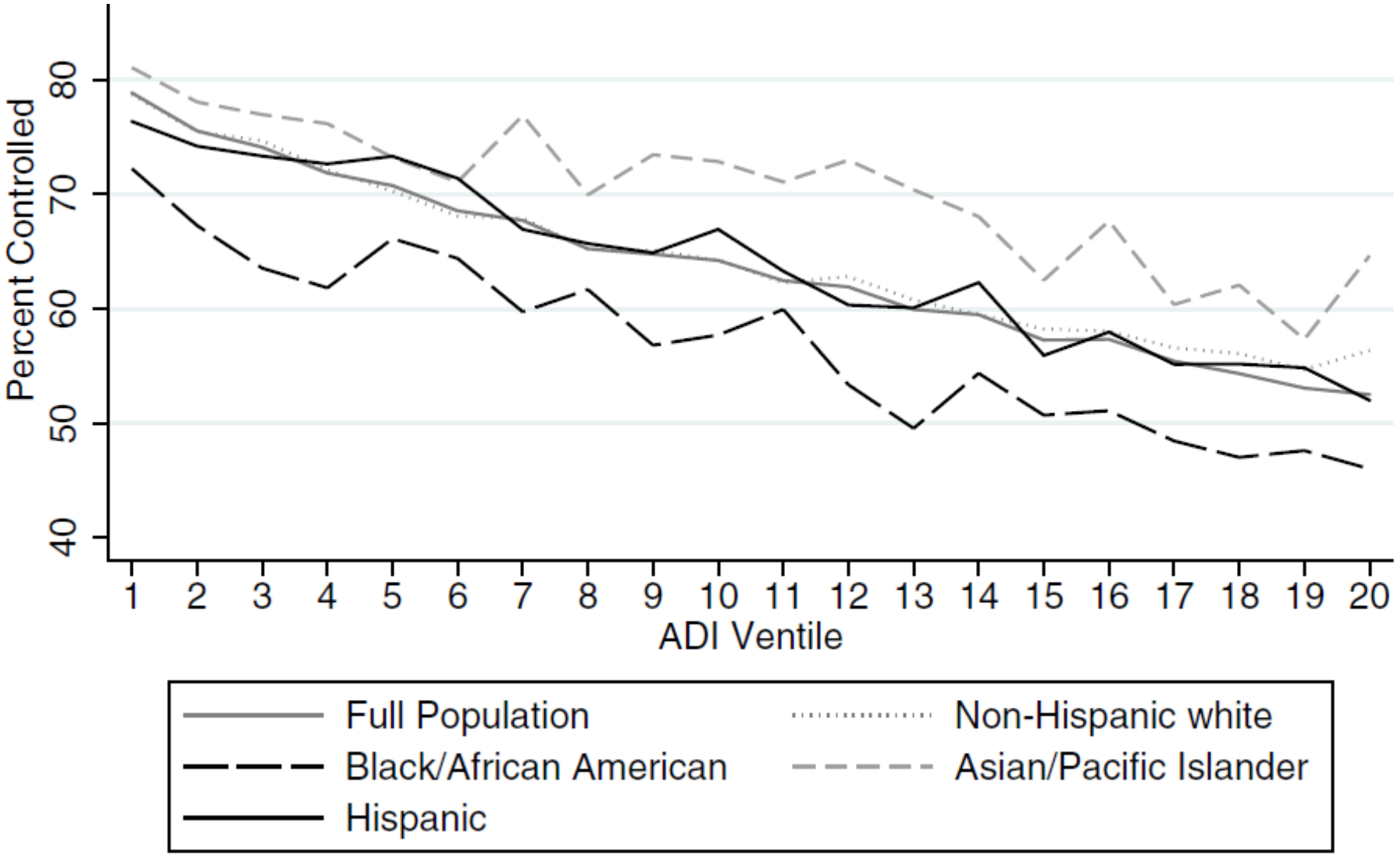


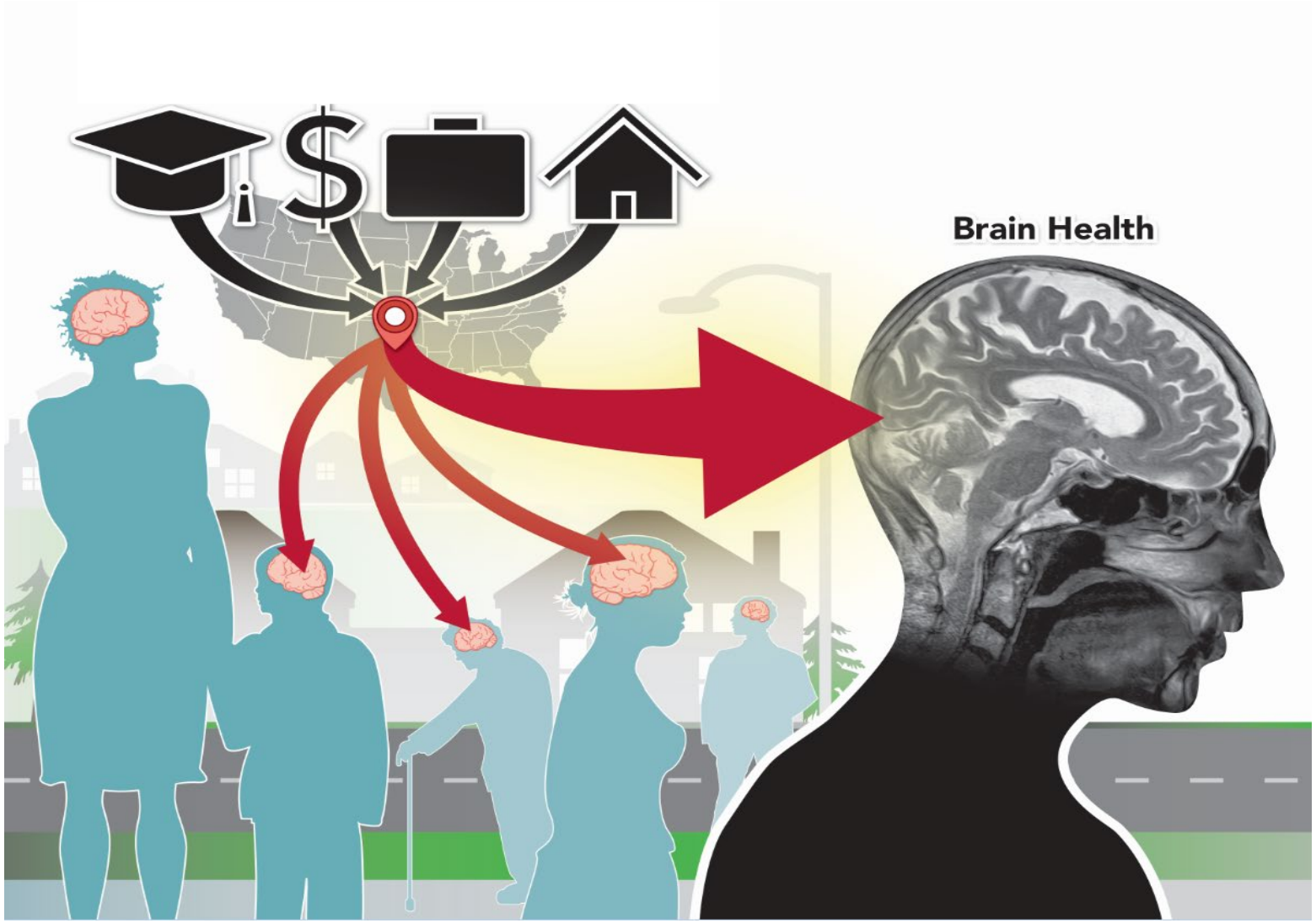
Figure 1. Association between Area Deprivation Index (ADI) and the highest single Confusion Assessment Method Severity score rating during hospitalization (CAM-S Peak) in the Successful Aging After Elective Surgery cohort (N = 560). Analyses were completed using linear regression lines, and 95% confidence intervals were calculated using a standard formula (mean ± 1.96 * standard error).

Neighborhood Disadvantage and Cholesterol Control in Medicare Advantage



*Durfey et al, *HSR*, 2019

NEIGHBORHOOD DISADVANTAGE AND BRAIN HEALTH



Powell et al, JAMA Open 2020

ORIGINAL ARTICLE

Associations between Amygdala-Prefrontal Functional Connectivity and Age Depend on Neighborhood Socioeconomic Status

Bruce Ramphal[1], Mariah DeSerisy[2], David Pagliaccio[1], Elizabeth Raffanello[1], Virginia Rauh[3], Gregory Tau[1], Jonathan Posner[1], Rachel Marsh[1] and Amy E. Margolis[1]

[1]New York State Psychiatric Institute and Department of Psychiatry, Vagelos College of Physicians and Surgeons, Columbia University, New York, NY 10032, USA, [2]Department of Psychology, Fordham University, Bronx, NY 10458, USA and [3]Department of Population and Family Health, Mailman School of Public Health, Columbia University, New York, NY 10032, USA

Address correspondence to Bruce Ramphal, 1051 Riverside Drive, Box 74/Room 2403, New York, NY 10032, USA. Email: bruce.ramphal@nyspi.columbia.edu.

- Cross-sectional MRI study of 127 participants aged 5–25 years NYC area
- Reduced basolateral amygdala- prefrontal cortex functional connectivity at earlier ages in participants from more disadvantaged neighborhoods by ADI, independent of individual-level SES
- Reduced connectivity in more disadvantaged youth was associated with less anxiety

Biological Psychiatry:
Global Open Science

ARCHIVAL REPORT | ARTICLES IN PRESS

A Social Gradient of Cortical Thickness in Adolescence: Relations With Neighborhood Socioeconomic Disadvantage, Family Socioeconomic Status, and Depressive Symptoms

Jonas G. Miller • Vanessa Lopez • Jessica L. Buthmann • Jordan Garcia • Ian H. Gotlib

Open Access • Published: March 16, 2022 • DOI: https://doi.org/10.1016/j.bpsgos.2022.03.005

- Cross-sectional MRI study of 120 adolescents, 13-18yo
- Residence in a highly disadvantaged neighborhood linked to thinner cortex in left hemisphere, linked to more severe depression symptoms. Family SES not associated.

Neurology®
The most widely read and highly cited peer-reviewed neurology journal
Subscribe My Alerts Log in Log out
AMERICAN ACADEMY OF NEUROLOGY.
Home Latest Articles Current Issue Past Issues Residents & Fellows

April 14, 2021 ARTICLE

Association of Neighborhood Context, Cognitive Decline, and Cortical Change in an Unimpaired Cohort

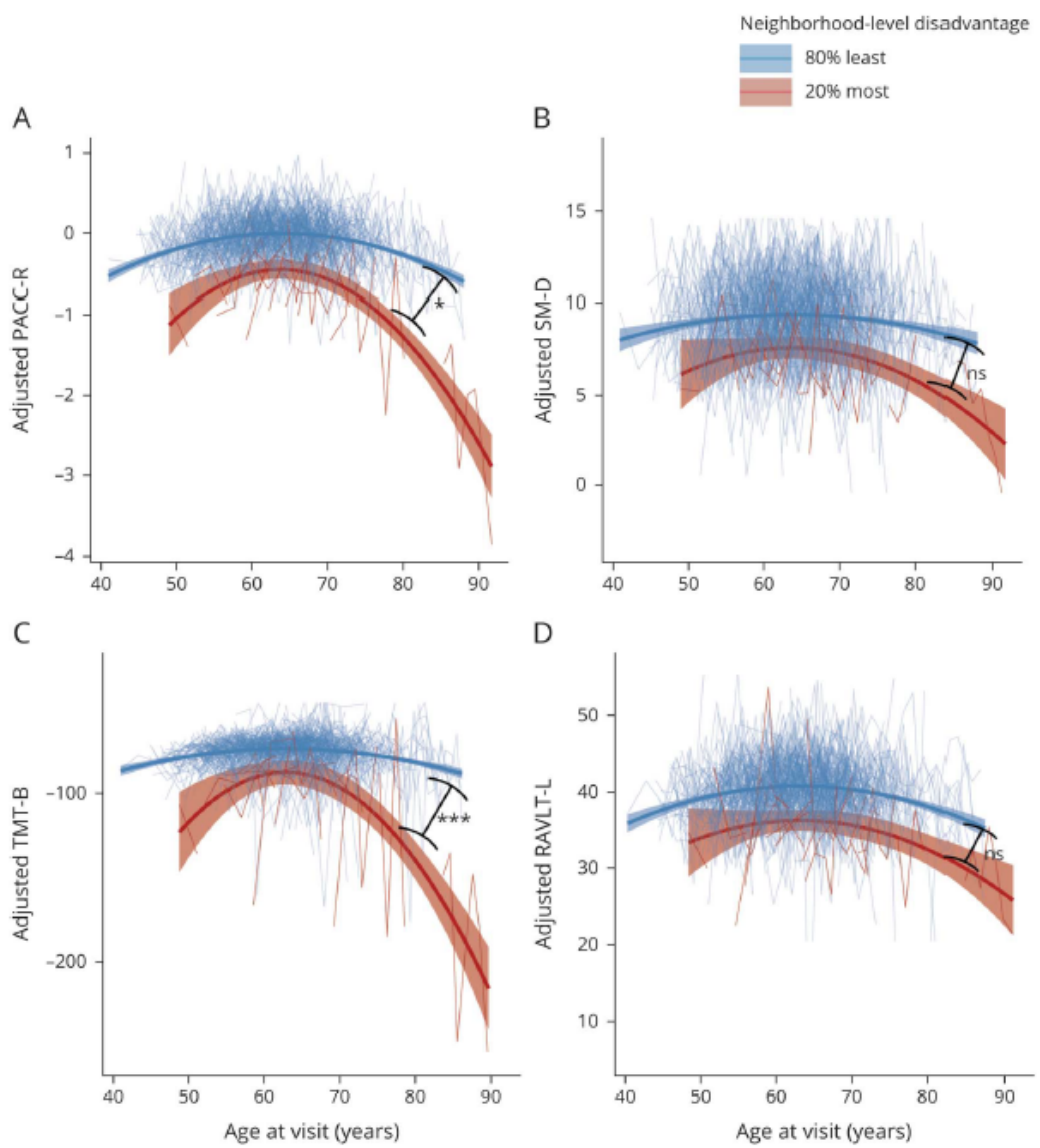
Jack F.V. Hunt, Nicholas M. Vogt, Erin M. Jonaitis, William R. Buckingham, Rebecca L. Koscik, Megan Zuelsdorff, Lindsay R. Clark, Carey E Gleason, Menggang Yu, Ozioma Okonkwo, Sterling C. Johnson, Sanjay Asthana, Barbara B. Bendlin, Amy J.H. Kind

First published April 14, 2021, DOI: https://doi.org/10.1212/WNL.0000000000011918

In this 10 year longitudinal study of cognitively unimpaired adults, living in the most highly disadvantaged neighborhoods was associated with accelerated degeneration (cortical thinning) in AD affected regions and more cognitive decline

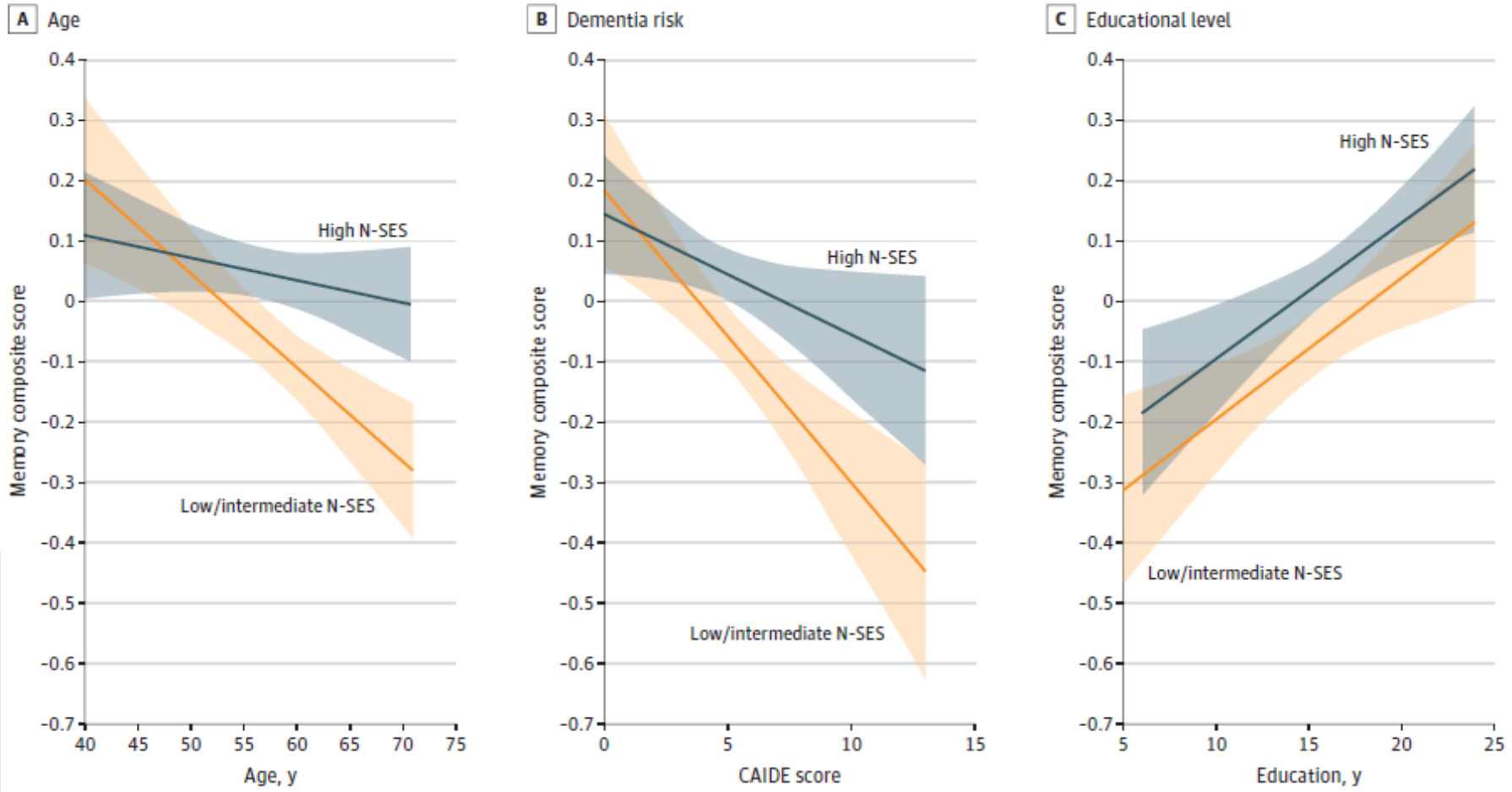
Hunt et al, Neurology, 2021

Figure 2 Association Between Neighborhood-Level Disadvantage and Longitudinal Cognitive Trajectories



Plots depict performance on Preclinical Alzheimer's Cognitive Composite–Revised (PACC-R) composite (A) and component subtests (B–D) on the age on the x-axis. Higher scores equate to better performance on cognitive test (Trail-Making Test, part B [TMT-B] scores are multiplied by −1 fo consistency). Cognitive test scores are adjusted for sex, years of education, practice effects, and individual-level intercepts and slopes. Small line plot) depict individual trajectories; large lines depict estimated quadratic slopes for participants with the 80% least neighborhood-level disadva lines, n = 582) and 20% most disadvantage (red lines, n = 19). Participants from the most highly disadvantaged neighborhoods exhibited significan decline in PACC-R and TMT-B than participants from less disadvantaged neighborhoods, but showed no difference in decline of Story Memory Delay (SM-D) or Rey Auditory Verbal Learning Test, total trials 1–5 (RAVLT-L). Unadjusted *p* values for age2:neighborhood disadvantage interaction terms are displayed on plots for each cognitive test: ns $p > 0.05$, *$p < 0.05$, ***$p < 0.001$.

Figure 3. Association Between Memory Composite Score and Increasing Age, Dementia Risk Score, and Years of Education by Neighborhood-Level Socioeconomic Status (N-SES)



A, Means were adjusted for sex, years of education, race and residential location. B, Original dementia risk score from the Cardiovascular Risk Factors, Aging, and Incidence of Dementia (CAIDE) tool. Means were adjusted for race and residential location. C, Means were adjusted for age, sex, race, and residential location. The Cogstate Brief Battery memory composite score was based on composite *z* scores from the one card learning and one back tests. Higher scores indicate a higher number of correct responses. Neighborhood-level socioeconomic status was measured using the Index of Relative Socio-economic Advantage and Disadvantage, with deciles 1 to 7 indicating low to intermediate N-SES (n = 913) and deciles 8 to 10 indicating high N-SES (n = 1268). Shaded areas indicate 95% CIs.

Pase et al, "Association of Neighborhood-Level Socioeconomic Measures with Cognition and Dementia Risk in Australian Adults", JAMA Open 2022

JAMA Network Open

Original Investigation | Public Health

Association of Neighborhood-Level Disadvantage With Alzheimer Disease Neuropathology

W. Ryan Powell, PhD; William R. Buckingham, PhD; Jamie L. Larson, PhD; Leigha Vilen, BS; Menggang Yu, PhD; M. Shahriar Salamat, MD, PhD; Barbara B. Bendlin, PhD; Robert A. Rissman, PhD; Amy J. H. Kind, MD, PhD

Abstract

IMPORTANCE Social determinants of health, such as income, education, housing quality, and employment, are associated with disparities in Alzheimer disease and health generally, yet these determinants are rarely incorporated within neuropathology research.

OBJECTIVE To establish the feasibility of linking neuropathology data to social determinants of health exposures using neighborhood disadvantage metrics (the validated Area Deprivation Index)

Key Points

Question Can neighborhood disadvantage, a social determinant of health, be incorporated into existing brain bank data to evaluate the risk of biological outcomes, such as Alzheimer disease neuropathology?

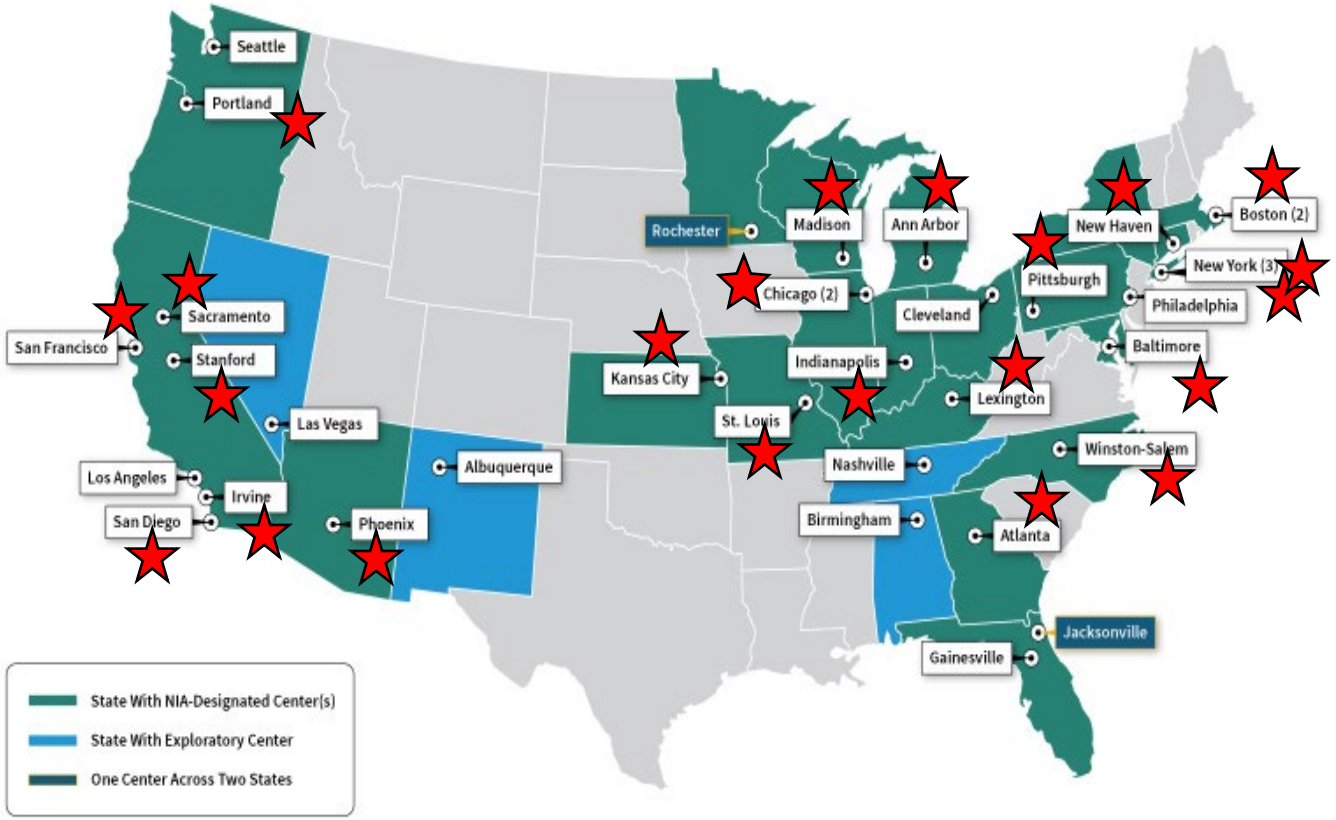
Living in the most disadvantaged neighborhood decile was associated increased odds of AD neuropathology

June 11, 2020

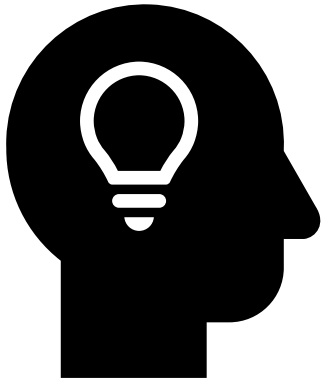
THE NEIGHBORHOODS STUDY

(R01AG070883; PI KIND, MPI BENDLIN)

- Novel collaborative multi-site initiative to examine the impact of life-course exposome on brain health
- Over 9,000 ADRC brain bank decedents
- 7,875 ADRC clinical core participants
- 22 Alzheimer's Disease Research Centers



POLICY ACTIONABLE METRICS ARE…

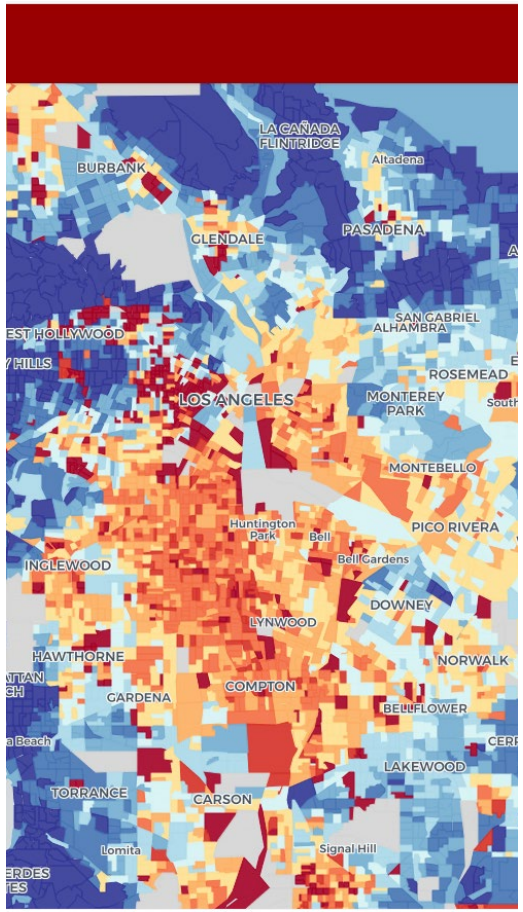


1. Inclusive of all targeted persons in a political unit (generalizable)
2. Regularly updated (timely)
3. Rigorously tested (valid)
4. Accessible to all (open)
5. Constructed to meet the needs of a range of possible users (understandable)

*Kind et al, NEJM 2018

THE NEIGHBORHOOD ATLAS

www.neighborhoodatlas.medicine.wisc.edu

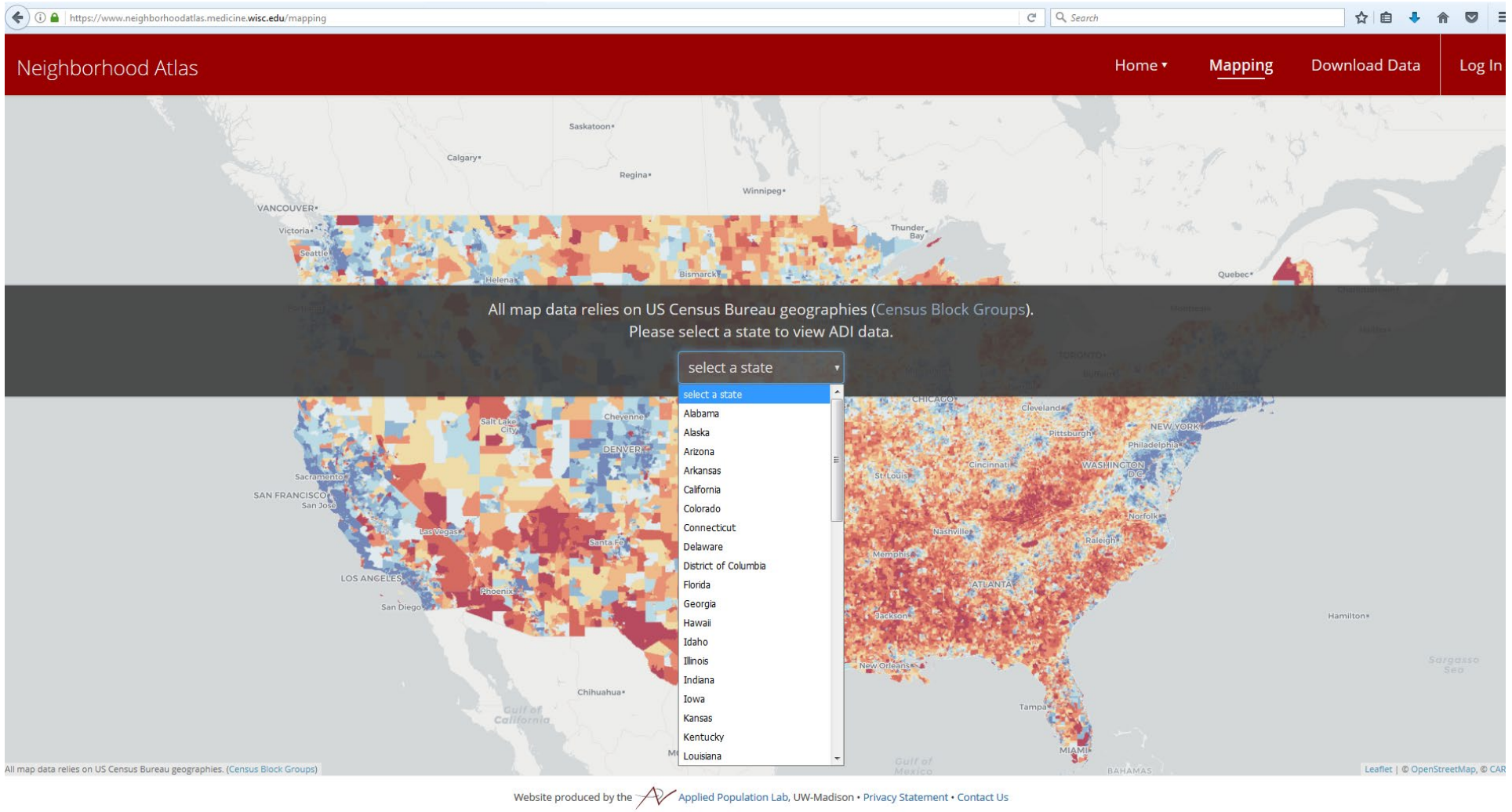


- Data democratization and open science tool for the ADI
- Customized mapping; Free, open to all
- Nearing one-half of a million views
- Data downloaded tens of thousands of times by research, governmental, community, and industry groups.

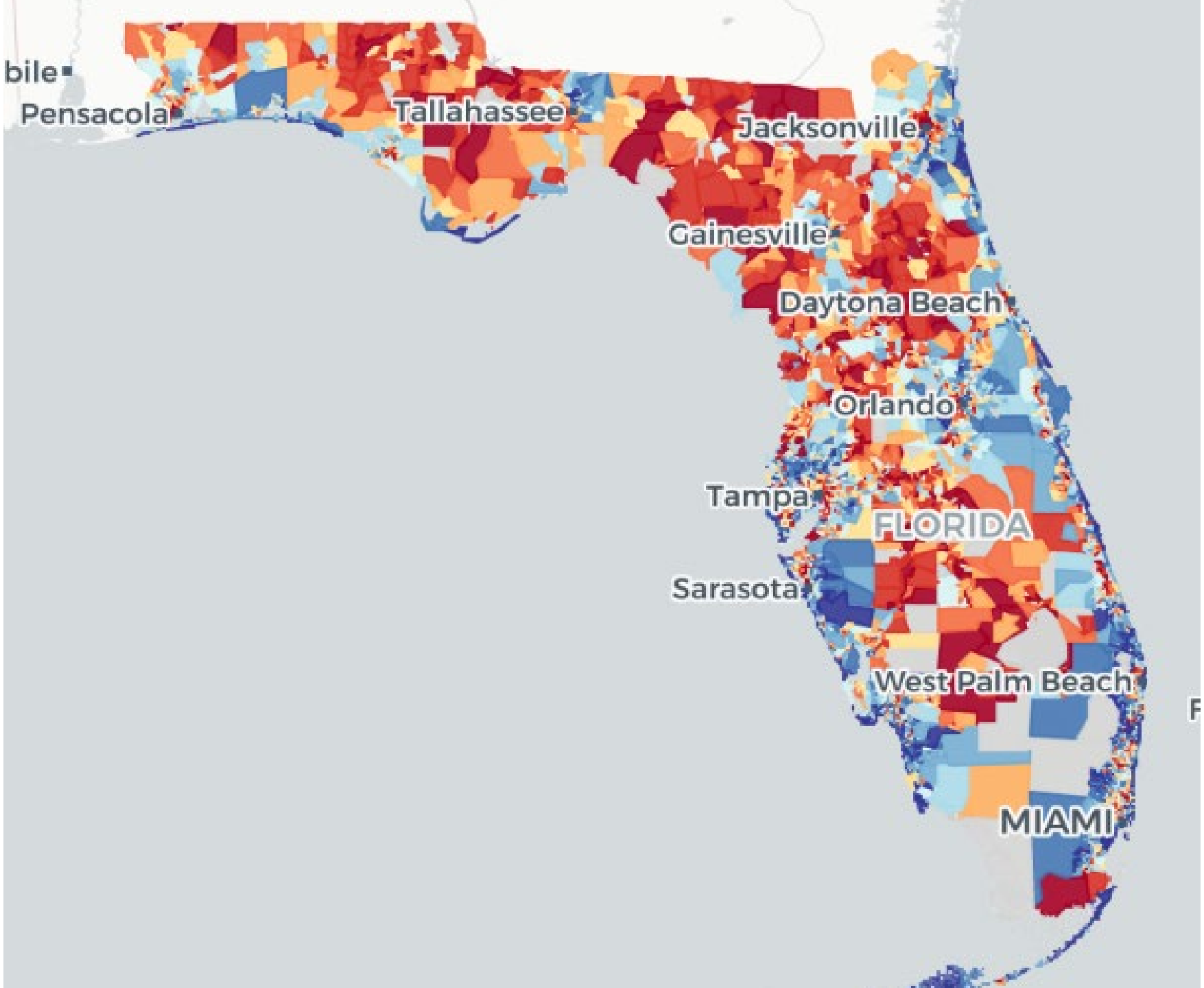
*Kind NEJM 2018

THE NEIGHBORHOOD ATLAS

www.neighborhoodatlas.medicine.wisc.edu



*Kind NEJM 2018


bile
Pensacola
Tallahassee
Jacksonville
Gainesville
Daytona Beach
Orlando
Tampa
FLORIDA
Sarasota
West Palm Beach
MIAMI

NEIGHBORHOOD ATLAS: CATALYZING DISPARITIES RESEARCH

NIH Promotion of the Atlas

- Catalyzing dissemination
- Embedding Atlas metrics (ADI) in multiple NIH core research resources

Other Examples

- Professional Medical Societies
- Industry

NEIGHBORHOOD ATLAS: INFORMING STRATEGIES TO MITIGATE DISPARITIES

Ethical Allocation of COVID Therapies

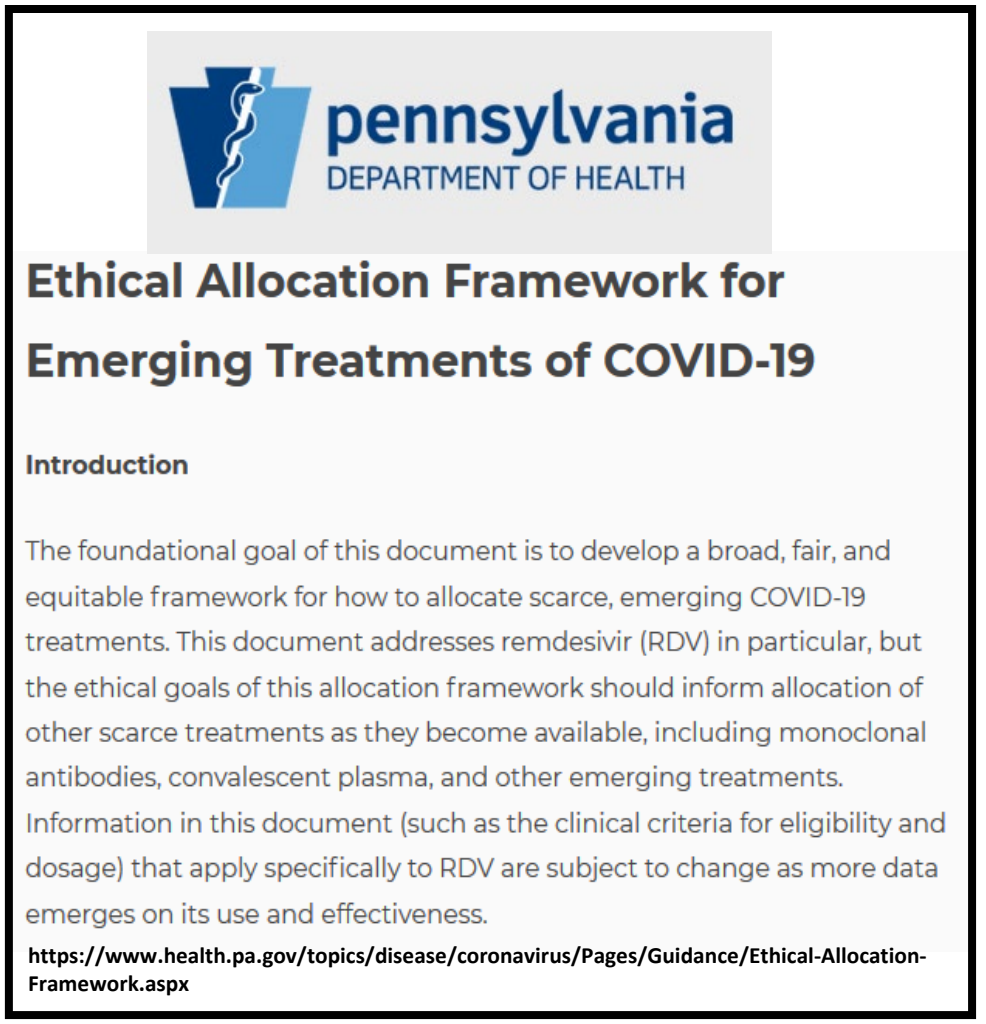
- Example: Pennsylvania

COVID Vaccine Resource Targeting

- Example: Alaska

Efficiently Aligning Health System Resources to Needs

- Example: US Centers for Medicare and Medicaid Services (CMS)
  - 2022 ACO Realizing Equity, Access, and Community Health (REACH) Model



Health Equity Benchmark Adjustment

ACO REACH includes a benchmark adjustment that increases benchmarks for ACOs serving higher proportions of underserved beneficiaries

CMS will stratify all beneficiaries aligned to ACO REACH using a composite measure of underservice that incorporates a combination of[1]:

Area Deprivation Index	Dual Medicaid Status
*Area-level measure of **local socioeconomic factors** correlated with medical disparities and underservice*	*Beneficiary-level measure of economic challenges affecting individuals' ability to access high quality care*
Percentile Score from 1-100	**25 Point Adjustment for Full or Partial Dual Eligibility**

91st – 100th Percentile (Top Decile)	***+$30 PBPM Adjustment***
51st – 90th Percentile (Middle 4 Deciles)	*No Adjustment*
1st – 50th Percentile (Bottom 5 Deciles)	*-$6 PBPM Adjustment*

1. CMS may explore other variables to include in this assessment and will notify applicants prior to the start of PY2023 if any other variables are included.

*2022 ACO Realizing Equity, Access, and Community Health (REACH) Model [https://innovation.cms.gov/media/document/aco-reach-fin-meth-webinar-slides}

CMS CENTERS FOR MEDICARE & MEDICAID SERVICES

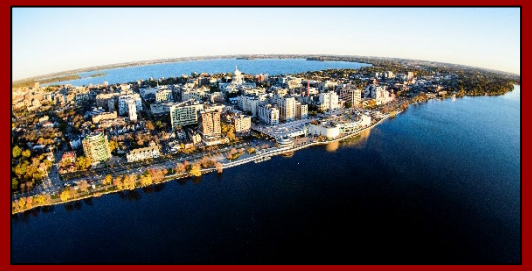
POWER OF POLICY

TIPS FOR RESEARCHERS

- Whenever possible design and conduct science that moves beyond description to align towards real-world solutions. Design to inform interventions and policy from the start

- Metrics of neighborhood disadvantage often reflect structural inequities in any country, including the US

- The Neighborhood Atlas is a freely available data democratization tool that provides customizable geographic images of block-group level ADI for anywhere within the US. The Atlas is available to everyone (including you!)

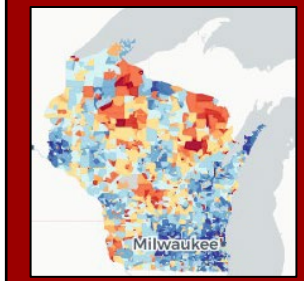


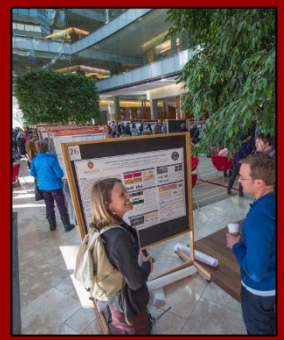

















Center for Health Disparities Research

UNIVERSITY OF WISCONSIN
SCHOOL OF MEDICINE AND PUBLIC HEALTH

ACKNOWLEDGEMENTS

Andrea Gilmore-Bykovskyi, PhD, RN**
Barbara B. Bendlin, PhD**
JP Yu, MD, PhD*
Manish Shah, MD, MPH*
Corrine Voils, PhD*
Menggang Yu PhD*
Ann Sheehy, MD, MS*
Shiva Bidar-Sielaff, MA, CDM
Stephanie Budge, PhD
Stephen Meyn, MD, PhD
Danielle Yancey, MS
Sanjay Asthana, MD
Elizabeth Burnside, MD, MPH, MS, FACR
Howard Bailey, MD
Pascale Carayon, PhD
Jason Fletcher, PhD
Jeff Linderoth, PhD
Katherine Magnuson, PhD
Lynn Schnapp, MD
Linda D. Scott, PhD, RN, NEA-BC, FNAP, FAAN
Steve Swanson, PhD
Jomol Mathew, PhD
Mallory Musolf, MA, NCDA
Nicole E. Werner, PhD
Susan Webb Yackee, PhD
Rachel Whitmer, PhD
Josh Grill, PhD
Robert Rissman, PhD
Robert Golden, MD
Jon Audhya, PhD
Rick Moss, PhD

The entire UW CHDR team
NIA Leadership, Program Officers and Staff

And many, many others . . .

Center for
Health Disparities Research
UNIVERSITY OF WISCONSIN
SCHOOL OF MEDICINE AND PUBLIC HEALTH

Funding

NIA R01 AG070883 (Kind PI; Bendlin MPI)
NIA RF1AG057784 (Kind PI; Bendlin MPI)
NIMHD R01MD010243-01 (Kind PI)
NIA P50AG062429 (Brewer PI)

** Deputy Director
* Executive Committee Member