RESEARCH TO ACTION:

Linking Exposome, Brain Health and Health Equity Policy

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RCCN Workshop: Aging, Race and Health Disparities

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FUNDING DISCLOSURES

NIH/National Institute on Aging

NIH/National Institute on Minority Health and Health Disparities

US Department of Veterans Affairs
HEALTH IS NOT DISTRIBUTED EQUALLY

Solutions Needed
NIA MECHANISTIC HEALTH DISPARITIES FRAMEWORK

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

Policy
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

* Jarman et al, BMJ 1983
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
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
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

A. Unadjusted model

B. Adjusted model

- Proportion of projected remaining life with disability (%)
- Age, y: 70, 75, 80, 85, 90
- Not disadvantaged
- Disadvantaged
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 Alejandro PhD, Edward R. Marcantonio MD, SM, Yun Gou MA, Richard N. Jones ScD ... See all authors

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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 = 569). 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

*Durfeey et al, HSR, 2019*
• 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
• 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.
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.
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. Age

High N-SES

Low/Intermediate N-SES

B. Dementia risk

High N-SES

C. Educational level

High N-SES

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

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*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
NIH Promotion of the Atlas

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

Other Examples

• Professional Medical Societies
• Industry
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:

<table>
<thead>
<tr>
<th>Area Deprivation Index</th>
<th>Dual Medicaid Status</th>
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<tbody>
<tr>
<td>Area-level measure of local socioeconomic factors correlated with medical disparities and underservice</td>
<td>Beneficiary-level measure of economic challenges affecting individuals’ ability to access high quality care</td>
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**Percentile Score from 1-100**

- **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

25 Point Adjustment for Full or Partial Dual Eligibility

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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]
POWER OF POLICY
• 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!)
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