

Biological age mediates the effects of perceived neighborhood disadvantage on heart failure risk in the ARIC-JHS cohort

Aging, Race, and Health Disparities workshop

Research Centers Collaborative Network

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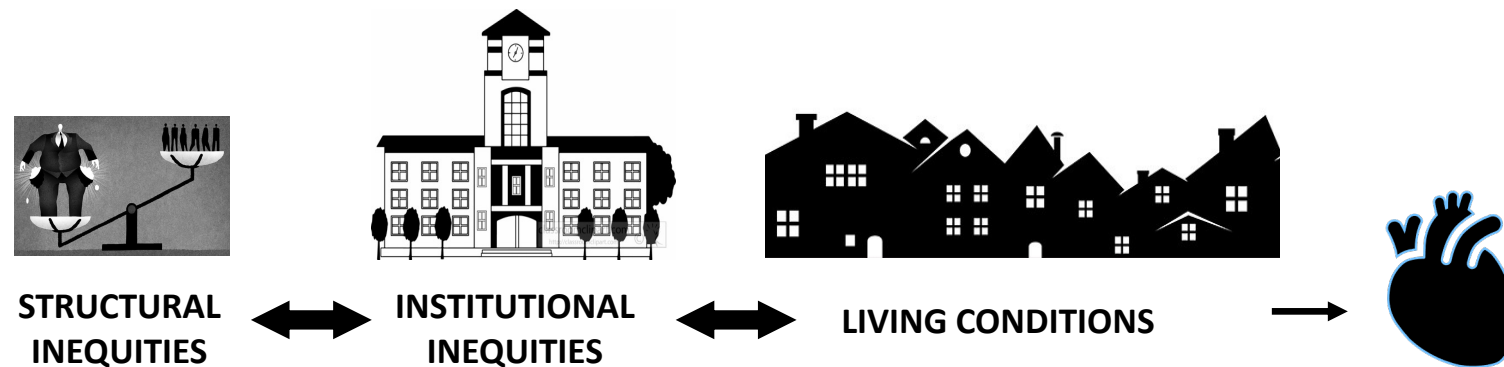
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Structural inequity and neighborhood disparities

Historical and current practices (structural inequity) concentrate Black populations within under-resourced neighborhoods

- Housing, economic, education policies
- Racial residential segregation → increased risk of physical and mental disease



Potential pathways

Neighborhoods provide protective resources, increased opportunities for health promoting behaviors

Physical activity, healthy eating, social interaction

Neighborhoods can cause stress

Stress can lead to accelerated aging, increased disease risk



Objective vs. subjective disadvantage

- Objective and subjective aspects of neighborhood may affect health in different ways
- Objective = “socioeconomic” = e.g. Area Deprivation Index
 - Predict health behaviors and access to and use of medical care
- Subjective = “psychosocial” = e.g. Perceived Neighborhood Problems
 - Individual measures aggregated at the neighborhood level
 - Correlate with objective measures but theory extends beyond influencing health behaviors and healthcare utilization

Chronic disease as a function of aging

- Geroscience theory reconceptualizes chronic disease as a product of sustained dysfunctional aging
- Many diseases share a core set of biological mechanisms which act over the life course
- Aging influenced by environmental stressors
 - Particularly epigenetic mechanisms

Biological age

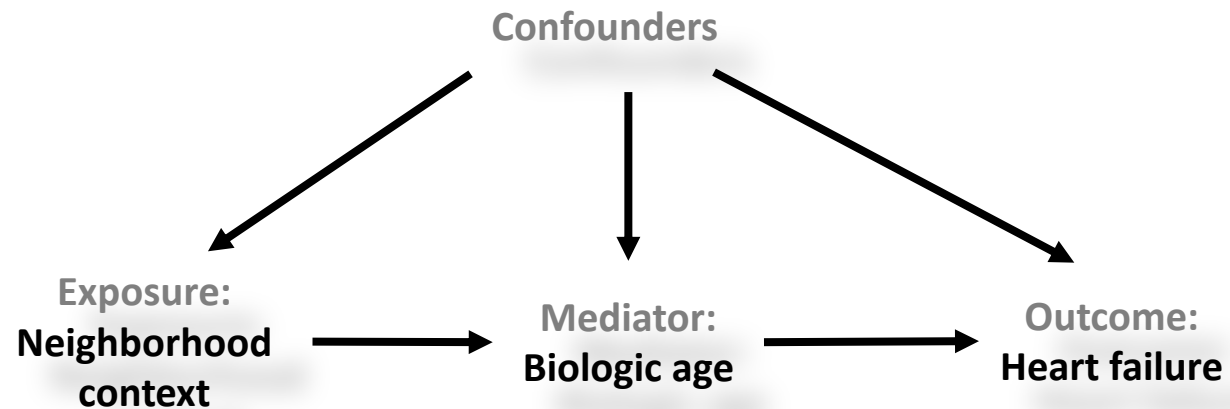
- Biological age = rate of increase in multisystem dysregulation over time
- Accelerated biological aging = multisystem dysregulation exceeding expectations of one's chronologic age

Knowledge gaps

- Most studies have focused on neighborhood SES
 - Few examine subjective aspects
- Clarity on physiological pathways to heart failure among Black populations

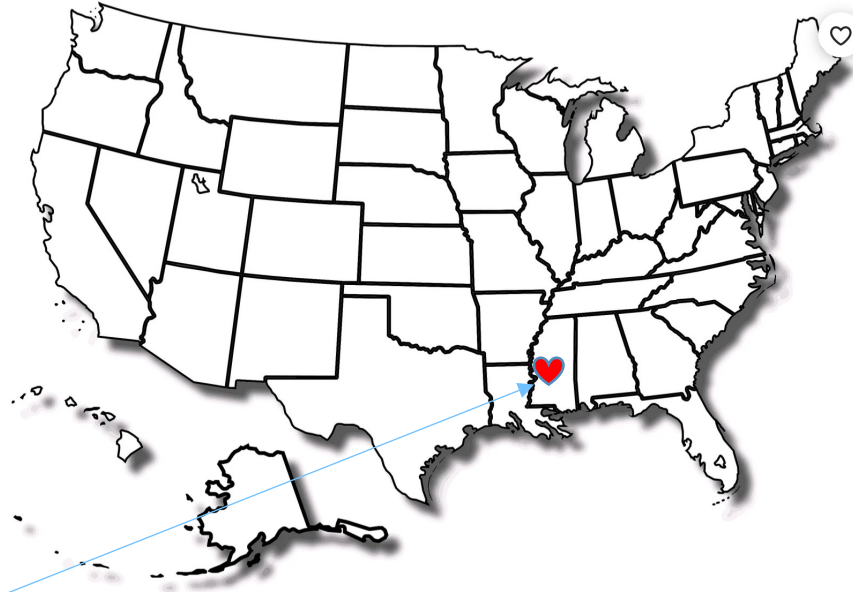
Study question

Does biological age mediate the effects of neighborhood disadvantage on heart failure?



Study design + population

- Multilevel longitudinal analysis
- JHS + ARIC cohort of self-reported African Americans
- Jackson, MS with 67 “neighborhoods”



Exposure: National Area Deprivation Index

- Data based on 2000 census publicly available for every state at the census tract level
 - 67 census tracts
- Factors for the theoretical domains of income, education, employment, and housing quality
- Each US census tract nationally ranked from 1 – 100

Exposure: Perceived neighborhood problems

- 6 items about neighborhood noise, heavy traffic and speeding cars; lack of access to adequate food/or shopping, parks; trash and litter
- Aggregated at the census tract level using multilevel categorical CFA
 - 32 combined census tracts

Covariates (time-invariant)

- Sex
 - Binary male/female
- Age
 - Continuous

Outcome

- Incident hospitalized heart failure
- Adjudicated by reviewer panel, based on medical records with:
 - Discharge ICD-9 code for HF
 - HF mentioned in physician notes
 - Diagnostic record of HF

Mediator

- Biological age = “GrimAge”
- Epigenetic “clock” = composite of DNA methylation-based markers for 8 plasma proteins and self-reported smoking packyears

Multiple levels of biological age

- Person level = measure based on individual DNAm
- Neighborhood level = measure of aggregate DNAm



Visit 1
1987-89

Visit 2
1990-91

Visit 3
1994-95

ADI U.S.
Census variables

Visit 7
2018-19

DNA measurement

Ongoing heart failure surveillance

Study period



Visit 1
2000-04

Health behaviors
Demographic variables
Perceived physical disorder

Methods

- Multilevel age- and sex-adjusted Cox causal mediation structural equation models
 - Natural direct and indirect effects
- % mediated = indirect/total effect
- Multiple imputation used to address missing data

Results

Adjusted hazard ratios and 95% confidence intervals among 1448 participants (mean age, SD = 64.3, 5.5) with 334 hospitalized HF events over a median follow-up of 18 years.

	Total effect	Person-level indirect effect	Neighborhood-level indirect effect
Area Deprivation Index	1.26 (0.98 - 1.56)	1.05 (0.98 - 1.12)	1.13 (0.94 – 1.33)
Perceived neighborhood problems	1.26 (1.10 - 1.41)	1.06 (1.01 - 1.12)	1.17 (1.02 - 1.34)
Mediated proportion		33.9%	60.9%

Main findings

- Nearly all (95%) of the effect of subjective neighborhood disadvantage on HF risk mediated by individual- and neighborhood-level biological age
- Perception of neighborhood matters
 - Effects most pronounced for subjective neighborhood dimension
 - May be operating along different pathway
- Evidence for network stress hypothesis
 - Others' experience of stress may impact risk of HF
 - Independent of one measure of the individual biological aging process

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Dedication

Dr. Gerardo Heiss



We found evidence that biological age mediates the effects of subjective neighborhood disadvantage on HF risk among Black adults.

Questions?