Neighborhood deprivation and breast cancer mortality

Lauren E. McCullough, PhD MSPH

Associate Professor, Epidemiology

Rollins School of Public Health, Emory University

lauren.mccullough@emory.edu

Today's Outline

- Disparities in Breast cancer outcomes
  - When and why?
- The need for population science: understanding *place*
- The 'ZNA': the intersection of *race* and place
- The emergence of *racism* in cancer equity research
- New initiatives in population science

Disparities in breast cancer outcomes: When and why?

Race disparities in cancer mortality

EMORY | ROLLINS SCHOOL OF PUBLIC HEALTH

Top sites among women

1.	Stomach	RR=2.31
2.	Myeloma	RR=2.24
3.	Endometrial	RR=1.97
4.	Cervical	RR=1.65
5.	Breast	RR=1.41
6.	Liver	RR=1.35
7.	Colorectal	RR=1.31
8.	Pancreas	RR=1.28
9.	Esophageal	RR=1.04
10.	Bladder	RR=1.04
All Sites		**RR=1.12**

Red text= higher deaths among Black women despite lower incidence

- 48% of the excess cancer deaths among Black women are due to breast cancer
  - Eliminating this disparity would yield significant progress towards cancer health equity among women

Table 6. Comparison of Cancer Death Rates between Black and White People, US, 2015-2019

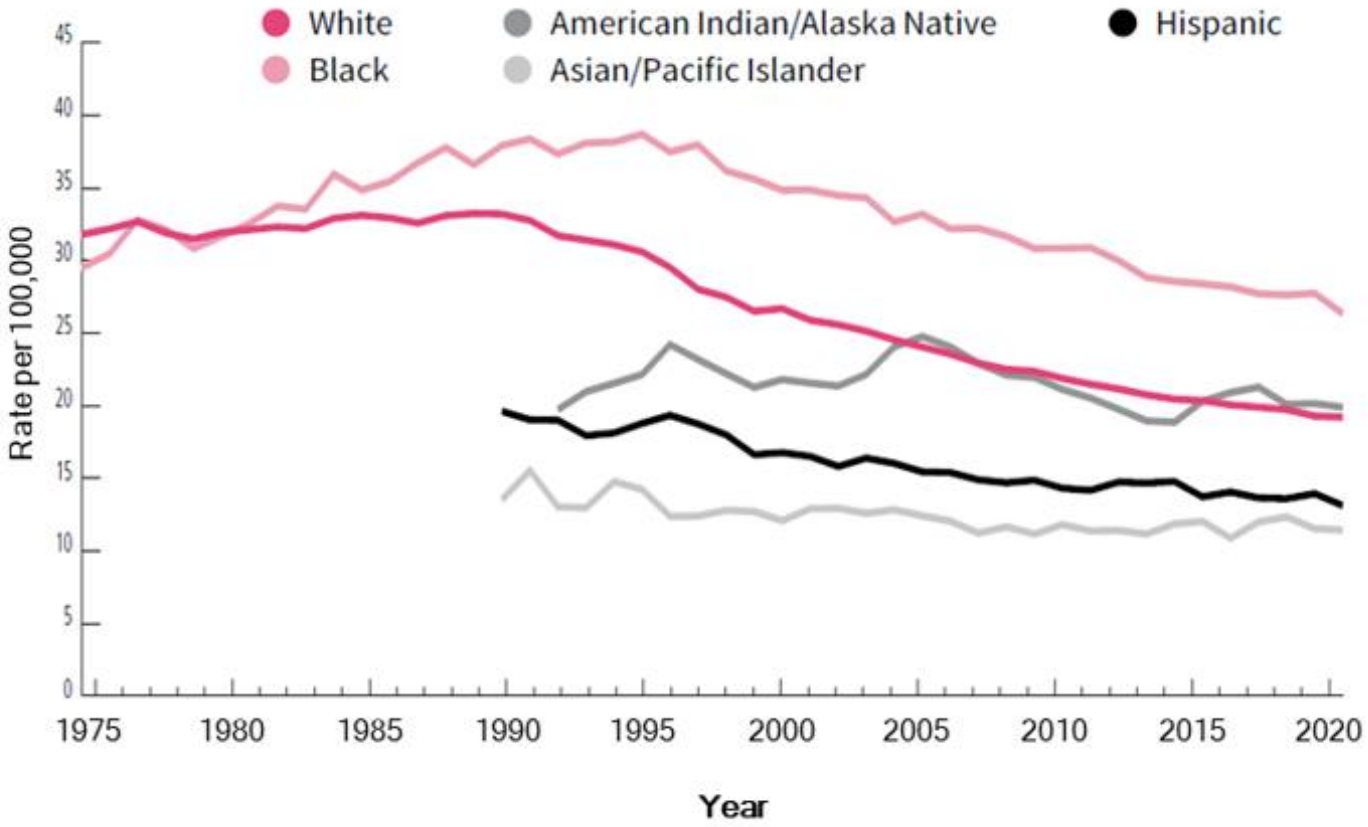
Female

Cancer	Black Rate*	White Rate*	Absolute Difference†	Rate Ratio‡
Stomach	3.5	1.5	2.0	2.31
Myeloma	5.1	2.3	2.8	2.24
Uterine corpus	9.0	4.6	4.4	1.97
Uterine cervix	3.4	2.0	1.4	1.65
Breast	28.0	19.9	8.1	1.41
Liver & intrahepatic bile duct	4.8	3.6	1.2	1.35
Colon & rectum	14.8	11.3	3.5	1.31
Pancreas	12.4	9.6	2.8	1.28
Esophagus	1.6	1.5	0.1	1.04
Urinary bladder	2.3	2.2	0.1	1.04
Kidney & renal pelvis	2.2	2.3	-0.1	0.95
Leukemia	4.3	4.8	-0.5	0.91
Ovary	5.9	6.9	-1.0	0.86
Lung & bronchus	29.2	34.2	-5.0	0.85
Hodgkin lymphoma	0.2	0.2	0.0	0.83
Non-Hodgkin lymphoma	3.1	4.2	-1.1	0.74
Brain & other nervous system	2.3	4.1	-1.8	0.56
Melanoma of the skin	0.3	1.8	-1.5	0.15
All sites	**152.1**	**135.4**	**16.7**	**1.12**

Cancer Facts and Figures for African Americans 2022-2024

US trends in female breast cancer mortality by race and ethnicity

The **disparity emerged in the 1980s** due to major advances in early detection and treatment which only benefited some women and with certain types of breast cancer



Declining overall but the **disparity maintained** over three decades

Unequal access to medical advances

Mammography (Incidence)

- Black and White women have had a **similar prevalence** of mammography
- **57% of Black women diagnosed with localized disease** compared to 68% of White women… Why
  - Mis-reporting?
  - Lower quality facilities
  - Delays in follow-up
  - Diagnosed with tumors that are less likely to be detected with a mammogram

Mammography (%) prevalence, women 45 years and older, US, 2019

	Up-to-date* (≥ 45 years)	Within the past 2 years (50-74 years)
Overall	**65**	**76**
Age (years)		
45-54	54	–
55-64	76	–
65-74	78	78
75+	54	–
Race/Ethnicity		
Hispanic/Latina	67	79
White	65	76
Black	69	79
Asian/Pacific Islander	60	74
American Indian/Alaska Native	54	63

Cancer Facts and Figures for African Americans 2022-2024

Unequal access to medical advances

Mammography (Incidence)

- Black and White women have had a **similar prevalence** of mammography
- **57% of Black women diagnosed with localized disease** compared to 68% of White women… Why
  - Mis-reporting?
  - Lower quality facilities
  - Delays in follow-up
  - Diagnosed with tumors that are less likely to be detected with a mammogram

Endocrine Therapy (Mortality)

- **Proven effective** for the treatment for hormone responsive tumors
  - Most prognostically favorable type of breast cancer
- The **Black-White disparity is most robust** in this group… Why?
  - Access to quality treatment
  - Treatment non-response and discontinuation
  - Adherence to long-term treatment (logistical and financial toxicities)

Cancer Facts and Figures for African Americans 2022-2024

Unequal access to medical advances

Mammography (Incidence)

- Black and White women have had a **similar prevalence** of mammography
- **57% of Black women diagnosed with localized disease** compared to 68% of White women… Why
  - Mis-reporting?
  - [illegible]
  - [illegible]
  - Diagnosed with tumors that are less likely to be detected with a mammogram

Endocrine Therapy (Mortality)

- **Proven effective** for the treatment for hormone responsive tumors
  - Most prognostically favorable type of breast cancer
- The **Black-White disparity is most robust** in this group… Why?
  - Access to quality treatment
  - Adherence to long-term treatment (logistical and financial toxicities)

Place, Race, or *RACISM*?

Cancer Facts and Figures for African Americans 2022-2024

The need for population science: understanding *place*

Epidemiology and health equity research

- Population science is essential to health equity research:
  - Race can't be randomized
  - Place can't be randomized
  - Many exposures of interest (e.g. racism) can't be randomized
- Time is a limiting factor
  - Disparities across the cancer continuum
  - Long-term follow up (*i.e.*, Breast Cancer has > 90% 5-year survival rate)
- Studies at the point of intervention (e.g., county/census tract) may yield interventions that are more readily amenable to federal, state, and local policy change
  - Long-term sustainability

Surveillance data to examine these factors in Georgia

GA Cancer Registry (SEER Program; Director Kevin Ward)

- Patient and tumor characteristics
- Treatment characteristics
  - Surgical characteristics, adjuvant therapy
  - Treatment facilities
- Oncotype Dx score
- Census-tract of residence at diagnosis → linkages to ACS and other geospatial data

Breast Cancer **I**nvestigation of **D**isparities in **Ge**orgia **(PI McCullough)**

The BRIDGE Cohort includes ~62,000 women diagnosed with a first-primary breast cancer in GA between 2010-2017 and identified in the Georgia Cancer Registry

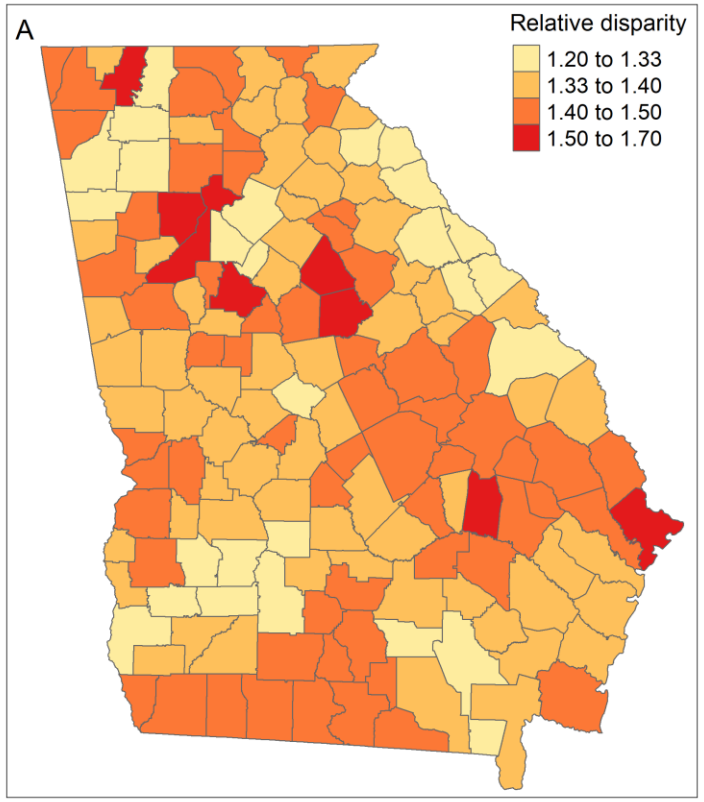
Mapping disparities across Georgia

- **GOAL: to understand the landscape of breast cancer disparities in Georgia**
  - Identify hot-spots and bright-spots (transportable?)
  - Understand how much area-level characteristics drive outcomes
  - Inform meaningful comparison groups for further interrogation
- **CHALLENGES:**
  - Local differences based on location of diagnosis NOT death (interventions)
  - Sparse data → Bayesian spatial modeling framework (smoothing)
  - Incorporating area-level data into models

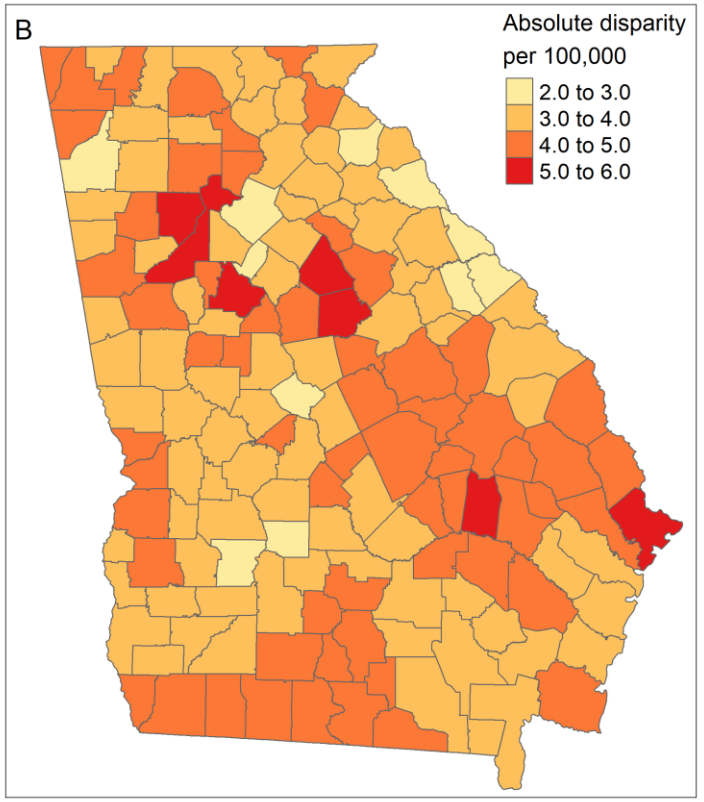
Nash et al. IN PREPRATION **(DO NOT POST)**

Multivariate ‘smoothed’ disparity (unadjusted)

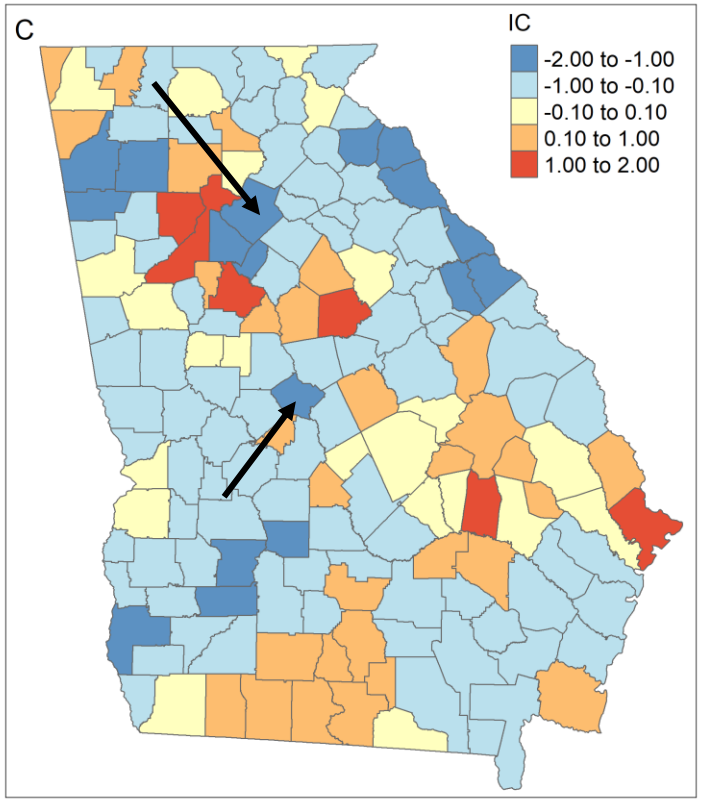
Relative disparity



Absolute disparity



Interaction Contrast



Nash et al. IN PREPRATION **(DO NOT POST)**

Effect of area level covariates on race-specific breast cancer mortality

Relative risk estimates of the effect of area-level characteristics
Median (95% credible interval)

Area-level Characteristic	Race	Model 1	Model 2	Model 3	Model 4	Model 5
Percent of adults with ≤ high school (HS) education	NHW	1.08 (1.04, 1.13)	1.10 (1.04, 1.17)	1.10 (1.04, 1.17)	1.11 (1.04, 1.17)	1.09 (1.02, 1.17)
	NHB	1.03 (0.97, 1.10)	0.99 (0.91, 1.08)	0.99 (0.91, 1.09)	0.99 (0.91, 1.08)	1.05 (0.94, 1.17)
Rurality (rural vs not rural)	NHW		0.92 (0.80, 1.07)	0.93 (0.81, 1.08)	0.92 (0.79, 1.06)	0.89 (0.75, 1.05)
	NHB		1.16 (0.94, 1.45)	1.16 (0.91, 1.45)	1.21 (0.98, 1.56)	1.28 (1.00, 1.64)
Percent Black	NHW			1.02 (0.99, 1.06)	1.03 (0.99, 1.08)	1.03 (0.99, 1.08)
	NHB			1.01 (0.97, 1.06)	1.00 (0.94, 1.05)	1.01 (0.95, 1.07)
Percent of owner-occupied housing units	NHW				1.03 (0.96, 1.12)	1.07 (0.95, 1.20)
	NHB				0.95 (0.85, 1.04)	0.87 (0.76, 1.00)
Percent with income below poverty level (in the last 12 months	NHW					1.07 (0.89, 1.29)
	NHB					0.82 (0.65, 1.03)

*Expressed as effect for a 10-point change in the percent

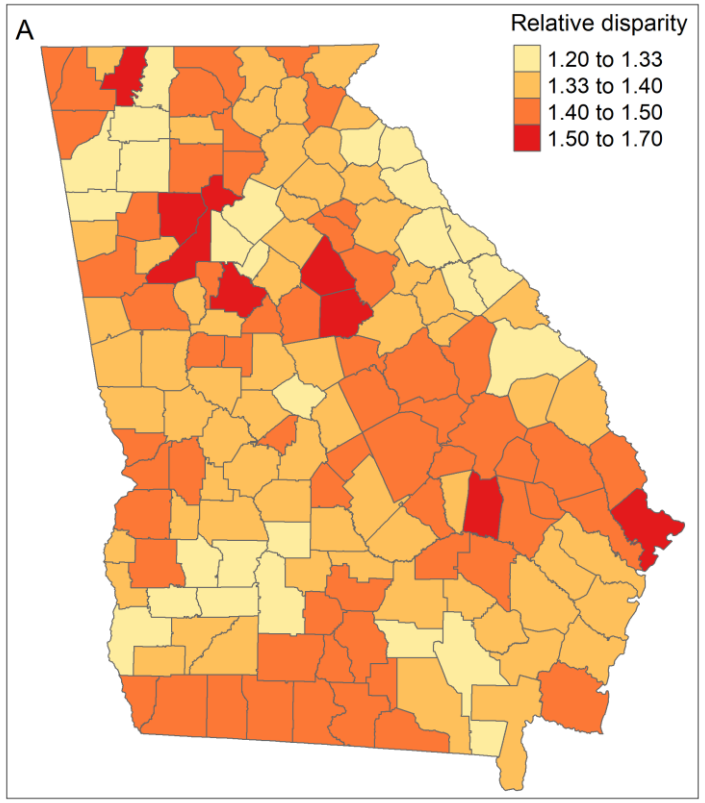
NHW=non-Hispanic White
NHB=non-Hispanic Black

Nash et al. IN PREPRATION **(DO NOT POST)**

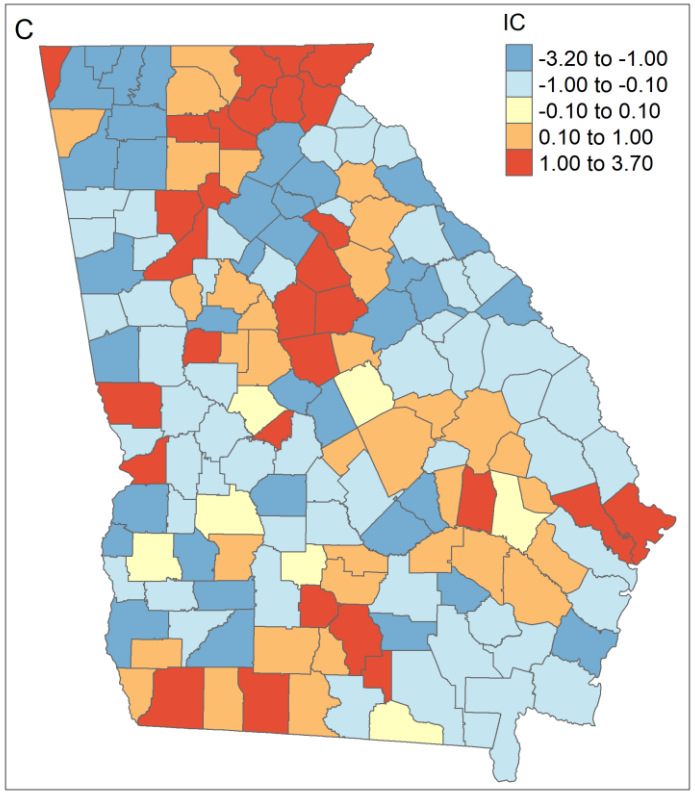
Multivariate “smoothed” disparity (adjusted)

EMORY | ROLLINS SCHOOL OF PUBLIC HEALTH

Unadjusted Model



Model 2 (+edu, rurality)



Nash et al. IN PREPRATION **(DO NOT POST)**

**Note: breaks are the same but min and max vary*

Mapping disparities across Georgia

- **TAKE HOME MESSAGES:**
  - There is substantial geographic heterogeneity in breast cancer mortality disparities throughout the state of Georgia
    - Previously masked by using place of death and approaches that do not account for sparse data
  - Accounting for rurality only magnifies the relative disparity, while equalizing the proportion of owner-occupied homes decreased the disparity.
  - A more complete understanding of the effect of rurality, housing, and other neighborhood characteristics on the race disparity requires more granular data.

Nash et al. IN PREPRATION **(DO NOT POST)**

The ‘ZNA’: the intersection of race and place

Race: Neighborhood deprivation and breast cancer mortality

- **BACKGROUND:** Living in deprived low SES neighborhoods may be associated with increase breast cancer mortality
  - Multiple neighborhood deprivation composite measures used across studies have yielded different results
  - Stronger association in White vs. Black women
  - No study has interrogated the reasons for weak associations among Black women
- **GOAL:** To assess the association between neighborhood deprivation (using multiple indices) and breast cancer mortality by race; to assess interactions with urban/rural status, racial composition*, and residential mobility **

Barber et al. IN PREPRATION **(DO NOT POST)**

A shift in thinking…

- **TAKE HOME MESSAGES:**
  - Among all women, neighborhood deprivation is associated with breast cancer mortality (across indices)
    - Neighborhood-level economic factors (poverty, household income, education) appear to drive the neighborhood deprivation-breast cancer mortality association
  - Neighborhood deprivation associates with breast cancer mortality **ONLY** among White women
    - Especially those living in rural neighborhoods (less access) with greater mobility (less social cohesion) and a greater % of Black residents (residential segregation)
  - No association among NHB women
    - Rurality, mobility, and neighborhood racial composition do not explain the null association
    - **Social drivers related to BC mortality are more limited among White women → BIGGER effect**
      - Among Black women there are multiple social drivers (*i.e.*, a piling on of causal effects)

Barber et al. IN PREPRATION **(DO NOT POST)**

The emergence of *racism* in cancer equity research

Disparity to Justice

Equality

The assumption is that **everyone benefits from the same supports**. This is equal treatment.

Equity

Everyone gets the supports they need (this is the concept of "affirmative action"), thus producing equity.

Justice

All 3 can see the game without supports or accommodations because **the cause(s) of the inequity was addressed**. The systemic barrier has been removed.

The ***barrier*** is racism

Ingham County, Michigan Health Department
http://www.hd.ingham.org/DepartmentalDirectory/CommunityHealth,Planning,andPartnerships/HealthEquityandSocialJustice.aspx

The many definitions of racism?

Complexity

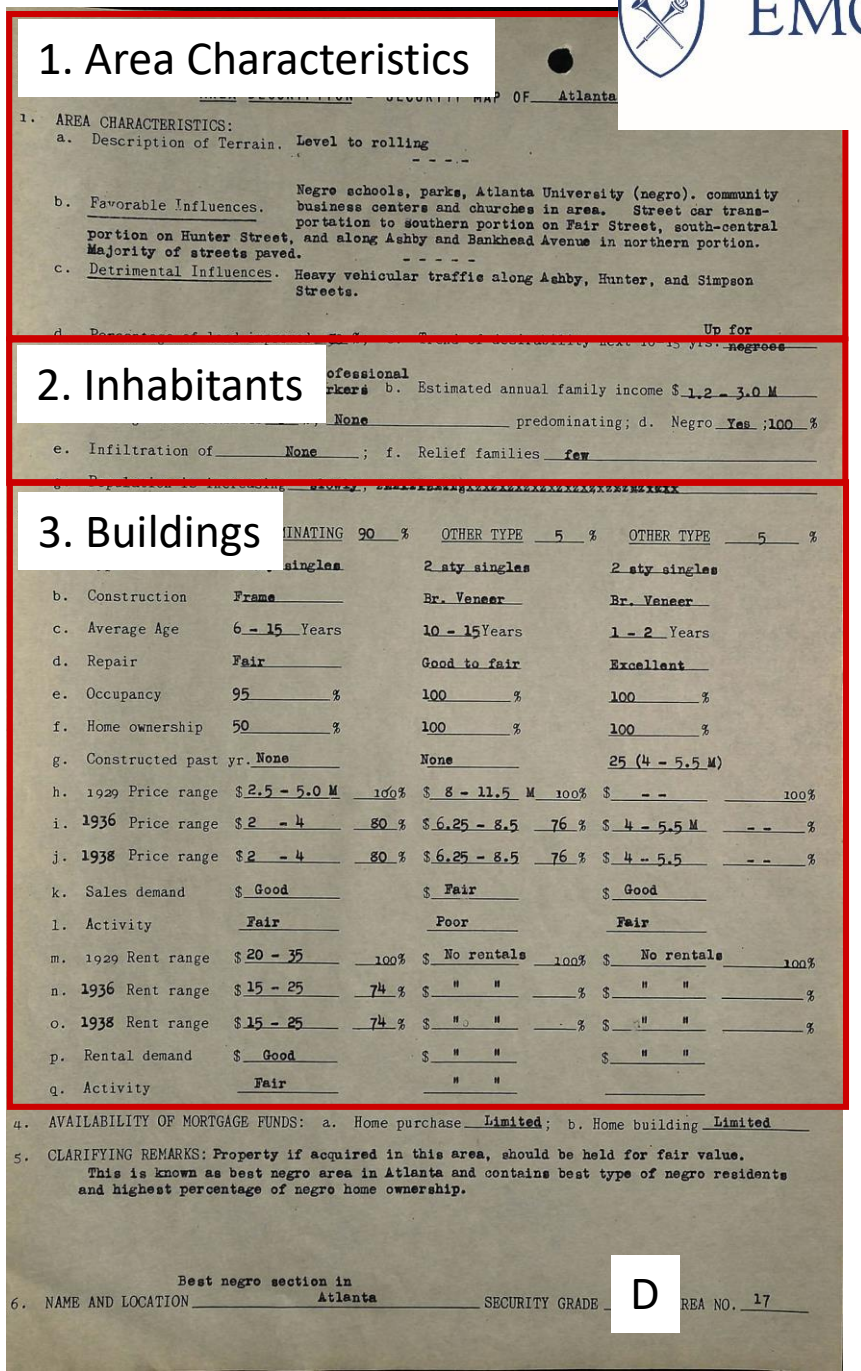
- Cultural racism, reflects the ideologies and societal norms about a particular race group
- Discrimination, an action that stems from racist beliefs
- Systemic racism, a descriptive term about racialized systems of power
- Institutional racism, racism within a particular type of institution (*e.g.*, housing or criminal justice)

Structural racism represents the totality of ways in which **multiple systems and institutions interact** to assert racist policies, practices, and beliefs about people in a racialized group.

Historical Redlining

- In 1933, US Congress created the Home Owners' Loan Corporation (HOLC) as part of the New Deal
- Between 1935 and 1940, the HOLC created "Residential Security" maps for 200+ urban areas
- Informed by local real estate professionals, they ranked the perceived risk of investing in particular neighborhoods using a color-coded scale:

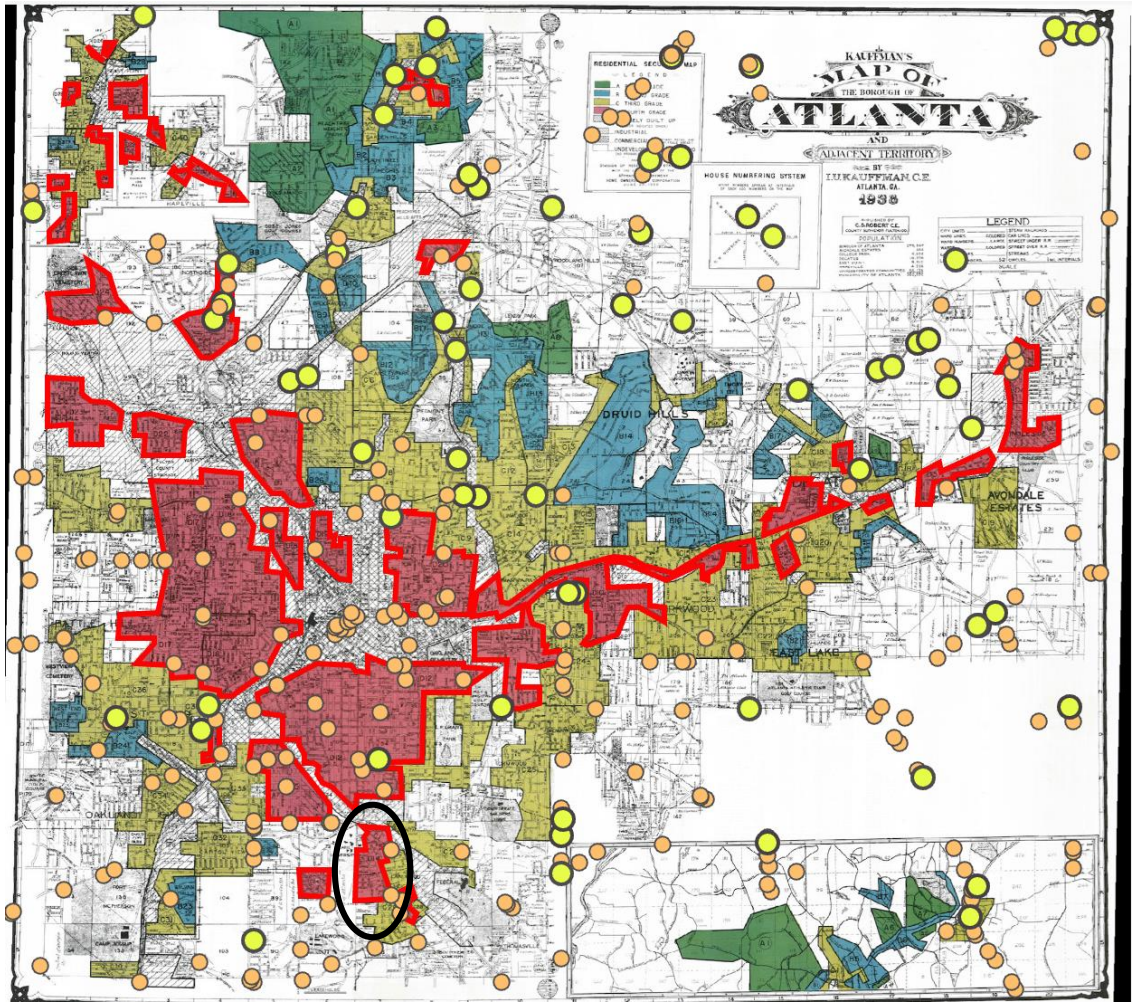
A: "Best"
B: "Still desirable"
C: "Definitely declining"
D: "Hazardous"



…Beyond housing

In addition to reduced real estate investments, persons living in redlined areas experienced increased exposure to environmental hazards and denial of goods and services.

- Poorer air quality
- Increased intra-urban heat
- A lack of greenspace
- Food deserts/swamps



https://www.atlantastudies.org/2018/08/14/jerry-shannon-from-food-deserts-to-supermarket-redlining-making-sense-of-food-access-in-atlanta/

Redlining and breast cancer mortality

Contemporary (CRL)

- 2016 (Beyer et al., Milwaukee) Redlining index was associated with a lower hazard among all women (HR=0.76; 95% CI=0.59, 0.98)
- 2021 (Collin CJ et al., Atlanta) Redlining index was associated with higher hazard among all women (HR=1.13; 95% CI=1.08, 1.17
  - White: HR=1.23; 95% CI=1.08, 1.41
  - Black: HR=1.03; 95% CI=0.97, 1.08
- 2021 (Beyer et al., SEER Medicare) Redlining index was associated with higher hazard among all women (HR =1.20; 95% CI=1.05, 1.37)

Historic (HRL)

- 2022 (Plascak et al., New Jersey) Redlining category best vs. hazardous*
  - White: HR=0.48; 95% CI=0.35, 0.65
  - Black: HR=0.78; 95% CI=0.53, 1.15

New initiatives in population science

Refining our thinking…

- One ‘institution’ or domain of structural racism is likely insufficient to capture the multidimensional and interacting elements of racism
  - Housing, economics, employment, education, criminal justice, voting, etc.
- Black women are taking multiple hits and all of these factors, likely contribute to disparities
- Currently, there no contemporary large-scale cohorts that comprehensively assess multiple measures of racism and how it impacts the development of aggressive tumor types and cancer-specific mortality

ACS cohort of 100,000 Black Women

- **Primary cohort (Pilot 2023): Cancer-free Black women (85,000)**
  - Age 25-55 years
  - 20 states with highest incidence of cancers among Black women (GA is a pilot state)
  - Recruitment model to capture women of diverse socioeconomic backgrounds
- **Sub-cohort (Pilot 2024): Black women newly diagnosed with cancer (15,000)**
  - Up to age 65 years
  - Black women newly diagnosed with breast, endometrial, or colon cancer
    - Collectively responsible for ~95% of all excess deaths among Black women
  - Get to outcomes-related answers faster!

Lauren McCullough, PhD, MSPH

Visiting Scientific Director, Epidemiology

Alpa V. Patel, PhD

Senior Vice President, Population Science

Acknowledgements

Collaborators

Kevin Ward, Jeffrey Switchenko, Michael Kramer, Timothy Lash, Joseph Lipscomb, Keerthi Gogineni, Mylin Torres, Preeti Subhedar, Karen Conneely, Sheryl Gabram-Mendola, Uma Krishnamurti, Jolinta Lin, Jade Jones, Anne Gaglioti, Kirsten Beyer

BRIDGE Trainees

Rebecca Nash, Lauren Barber, Jasmine Miller-Kleinhenz, Leah Moubadder, Lindsay Collin, Maret Maliniak, Alyssa Troeshel, Katie Ross-Driscoll, Whitney Do, Olivia D'Angelo, Miriam Cheriyan, Ming Yan, Jazib Gohar, Catherine Osborn, Kylee Broger, Brittany Crawford, Arthi Reddy, Hannah Kalvin, Nancy Nguyen, Jackie Lanning, Ellen Mitchell, Madison Gardner, Maya Bliss

Staff

Chava Bowden, Micah Streiff, Renjin Jiang, TJ Pierce

Consumer Advocate

Jacquelyn Bryant (2x BC Survivor)

Research Funding

NIH/NCI R01CA259192

NIH/NIA R56AG074886

Komen CCR19608510

V-Foundation V2017-005

AVON Foundation 01-2016-087

Winship Cancer Institute 00067187

Questions, Comments, & Conversations

Lauren E. McCullough, PhD, MSPH
Associate Professor, Epidemiology
lauren.mccullough@emory.edu
@Dr_LEMcCullough

Lauren E. McCullough, PhD, MSPH
Visiting Scientific Director,
American Cancer Society
lauren.mccullough@cancer.org