



# From Historical Redlining to Contemporary Gentrification: A Place-Based Investigation of Structural Determinants of Severe Maternal Morbidity

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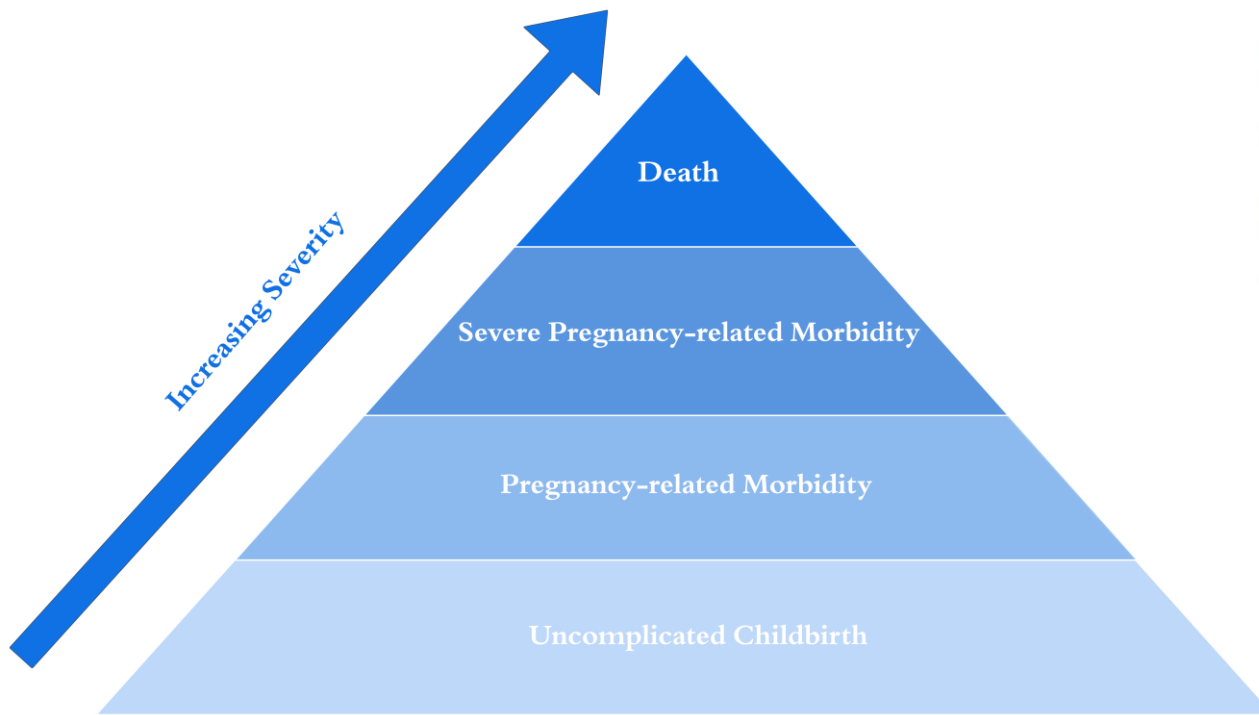
Coauthors: Rachel Morello-Frosch, Amani Nuru-Jeter, Jonathan Snowden, Suzan Carmichael, Mahasin Mujahid

**WCE**

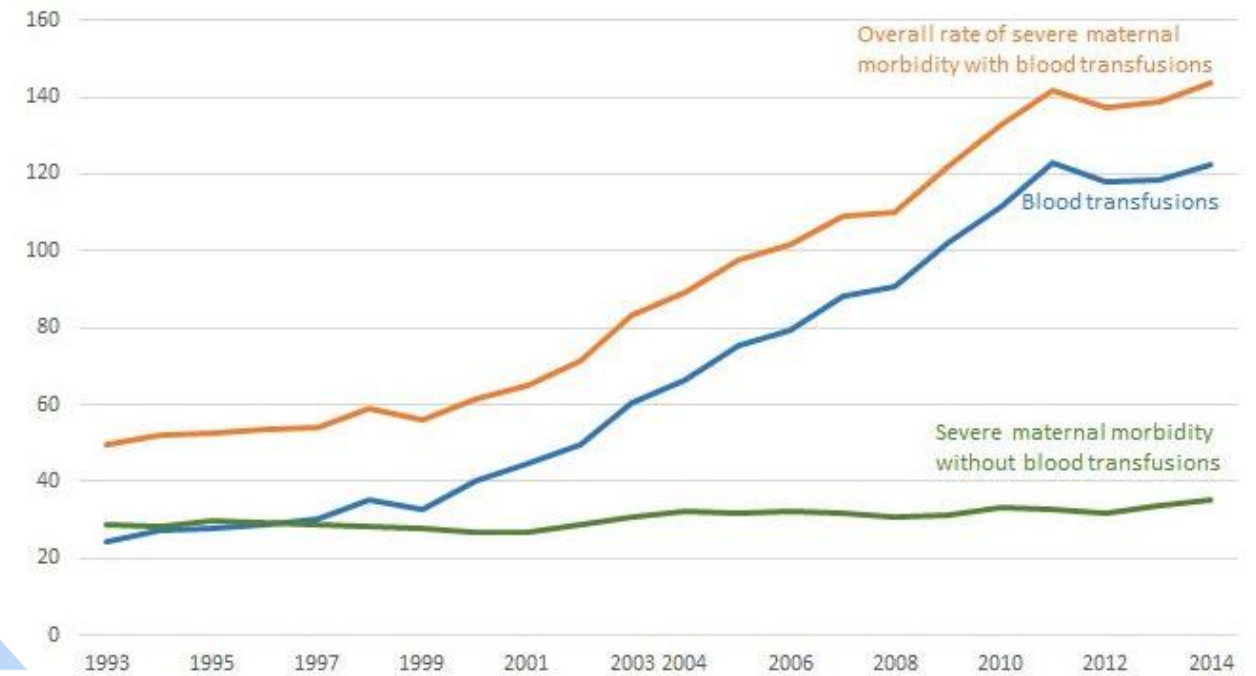
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# Severe Maternal Morbidity (SMM)



Rate of severe pregnancy-related morbidity per 10,000 delivery hospitalization



Source: <https://www.cdc.gov/reproductivehealth/maternalinfanthealth/severematernalmorbidity.html>; Carmichael et al., 2021

# Structural Determinants

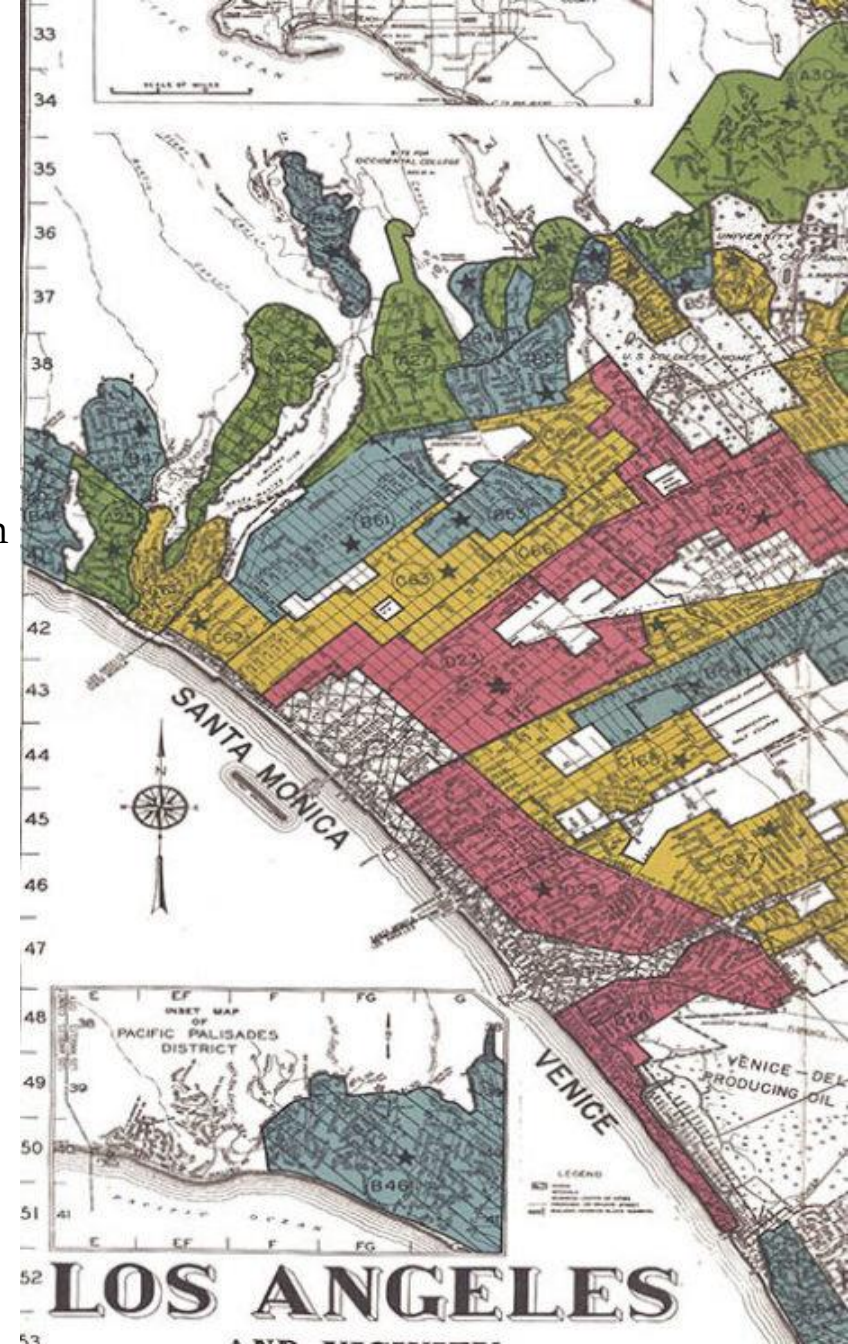
Institutional Policies

Economic Development

Social Marginalization

## Housing Discrimination

- Historical redlining – Home Owners’ Loan Corporation
- Racially restrictive covenants
- Exclusionary zoning
- Blockbusting
- Discriminatory lending/rental practices
- White flight
- Racial terror



# Structural Determinants



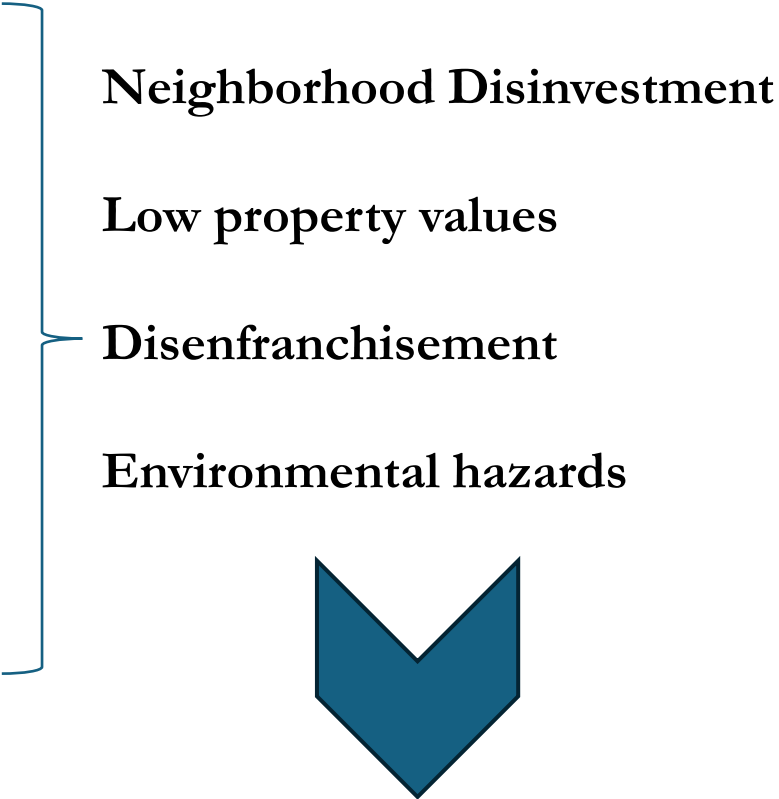
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**Economic Development**

**Social Marginalization**



**Gentrification**



# Gentrification

Definition: a racialized and profit-accumulating process in which historically disinvested neighborhoods experience private sector-led and government-subsidized development, resulting in the improvement of physical infrastructure but displacement of long-term residents and disintegration of communities.

Causa Justa :: Just Cause, 2015; Rucks-Ahidiana, 2021; Smith, 1998

## Oakland, California

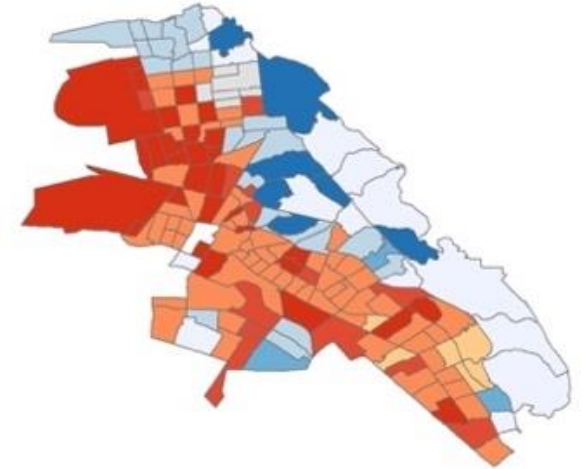
Mortgage Redlining



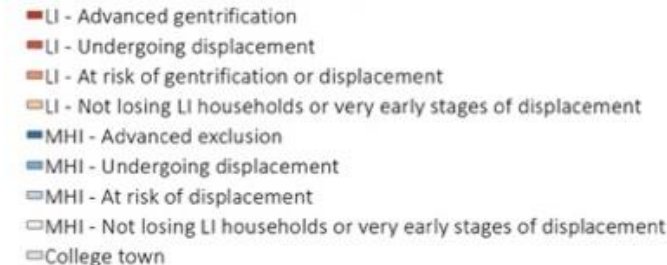
Home Owners' Loan Corporation Grade, 1930s



Gentrification



Urban Displacement Gentrification Typology, 2017



LI: Low Income  
MHI: Middle/High Income

# Research Aims

1.

Assess the impact of neighborhood past history of redlining and current experience of gentrification on severe maternal morbidity in California

2.

Examine whether associations are more pronounced among racially marginalized groups

# Study Population

California cohort of all recorded live births between 2005 and 2018

- Birth vital statistics, discharge records, and birth and fetal death certificates
- Exposure linked via address at delivery

Exclusion criteria

- Non-live births
- Missing exposure
  - Resided outside of redlining map coverage
  - Did not have gentrification information
- Missing covariate information



# Outcome Assessment: Severe Maternal Morbidity

1. Acute myocardial infarction
2. Aneurysm
3. Acute renal failure
4. Adult respiratory distress syndrome
5. Amniotic fluid embolism
6. Cardiac arrest/ventricular fibrillation
7. Conversion of cardiac rhythm
8. Disseminated intravascular coagulation
9. Eclampsia
10. Heart failure/arrest
11. Puerperal cerebrovascular disorder
12. Pulmonary edema
13. Severe anesthesia complications
14. Sepsis
15. Shock
16. Sickle cell disease with crisis
17. Air and thrombotic embolism
18. Blood products transfusion
19. Hysterectomy
20. Temporary tracheostomy
21. Ventilation



# Exposure Assessment

## Historical Redlining

Data Source: Mapping Inequality Lab  
Digitized Redlining Maps

- Not Redlined:
  - A: Best
  - B: Still Desirable
- Redlined
  - C: Definitely Declining
  - D: Hazardous

Assigned redlining grade based on census tract of the birthing person's residence using area-weight method

# Exposure Assessment

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## Contemporary Gentrification

Displacement and  
Gentrification  
Typology



Emphasizes housing affordability to low-, middle-, and high-income families



# Statistical Analysis

Mixed-effect logistic regression with a random intercept to account for clustering by census tract

Sequential covariate adjustment

- Sociodemographic: age, education, insurance
- Pregnancy-related factors: parity, birth type, any comorbidity

Assessed effect measure modification by race and ethnicity

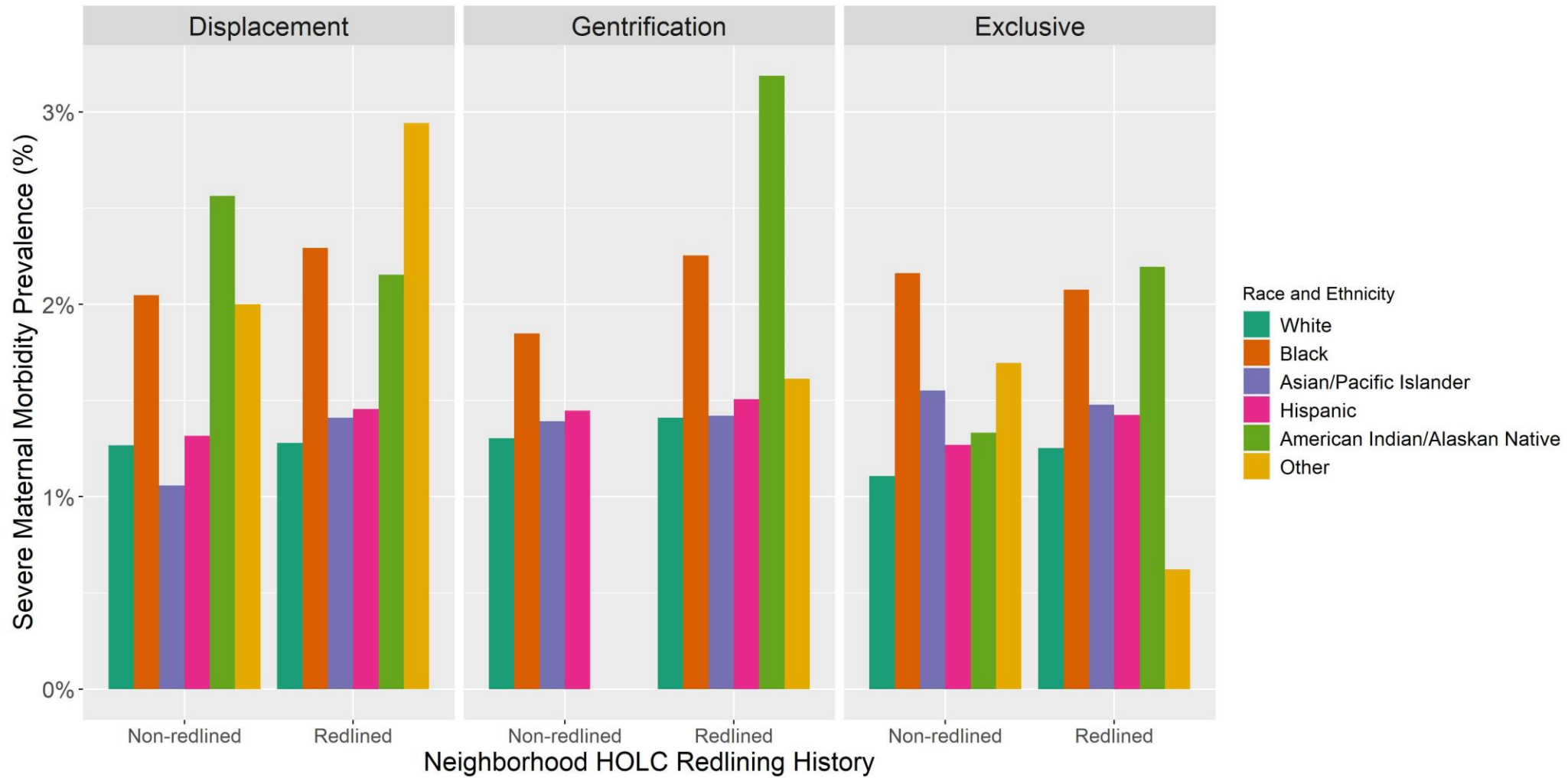
# Results

	Odds Ratio (95% CI)
Non-redlined + Exclusive	--
Redlined + Exclusive	1.12 (1.06-1.19)
Redlined + Displacement	1.21 (1.14-1.28)
Redlined + Gentrification	1.21 (1.13-1.29)
Non-redlined + Displacement	1.11 (1.00-1.23)
Non-redlined + Gentrification	1.14 (0.94-1.38)

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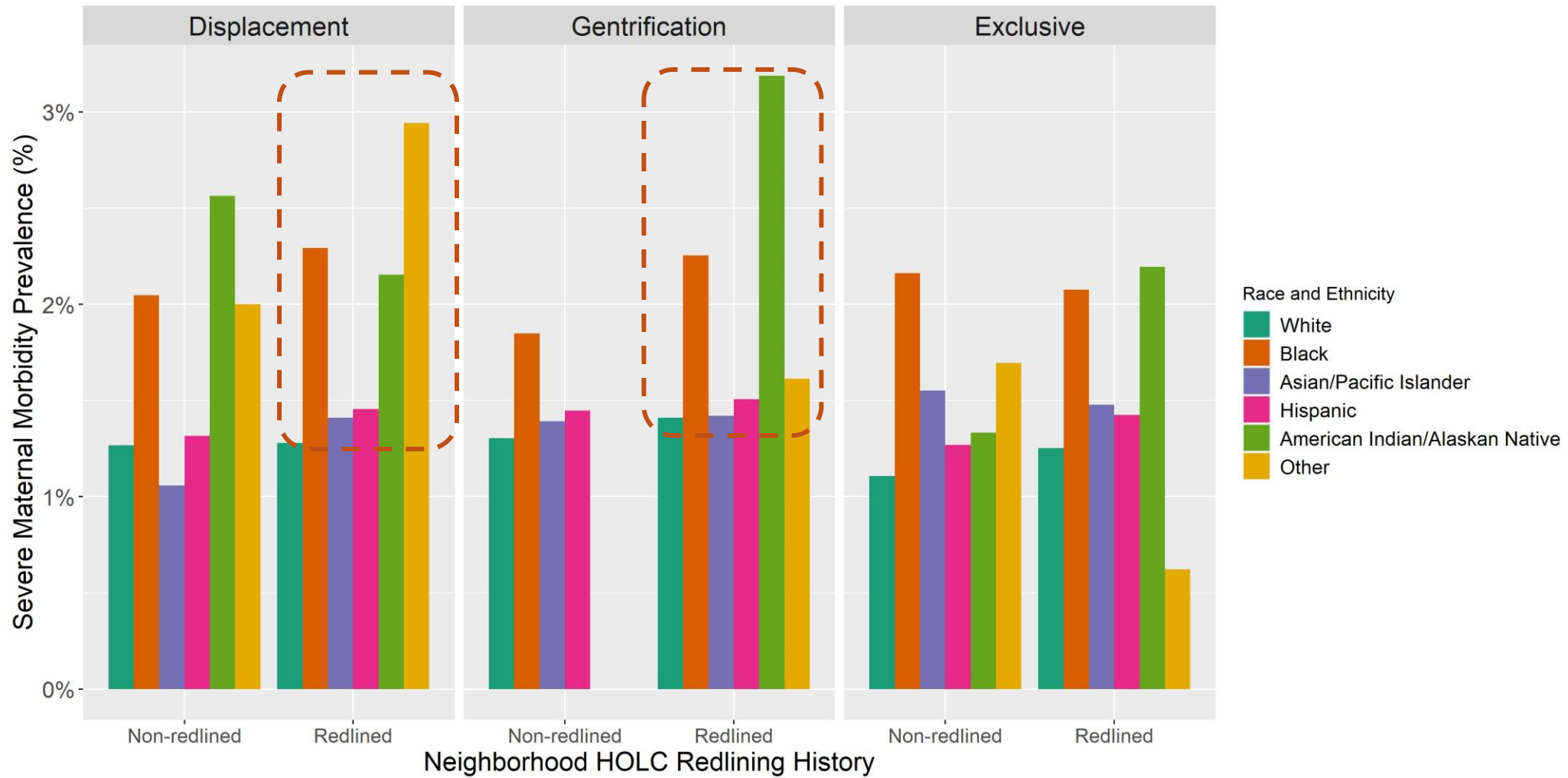
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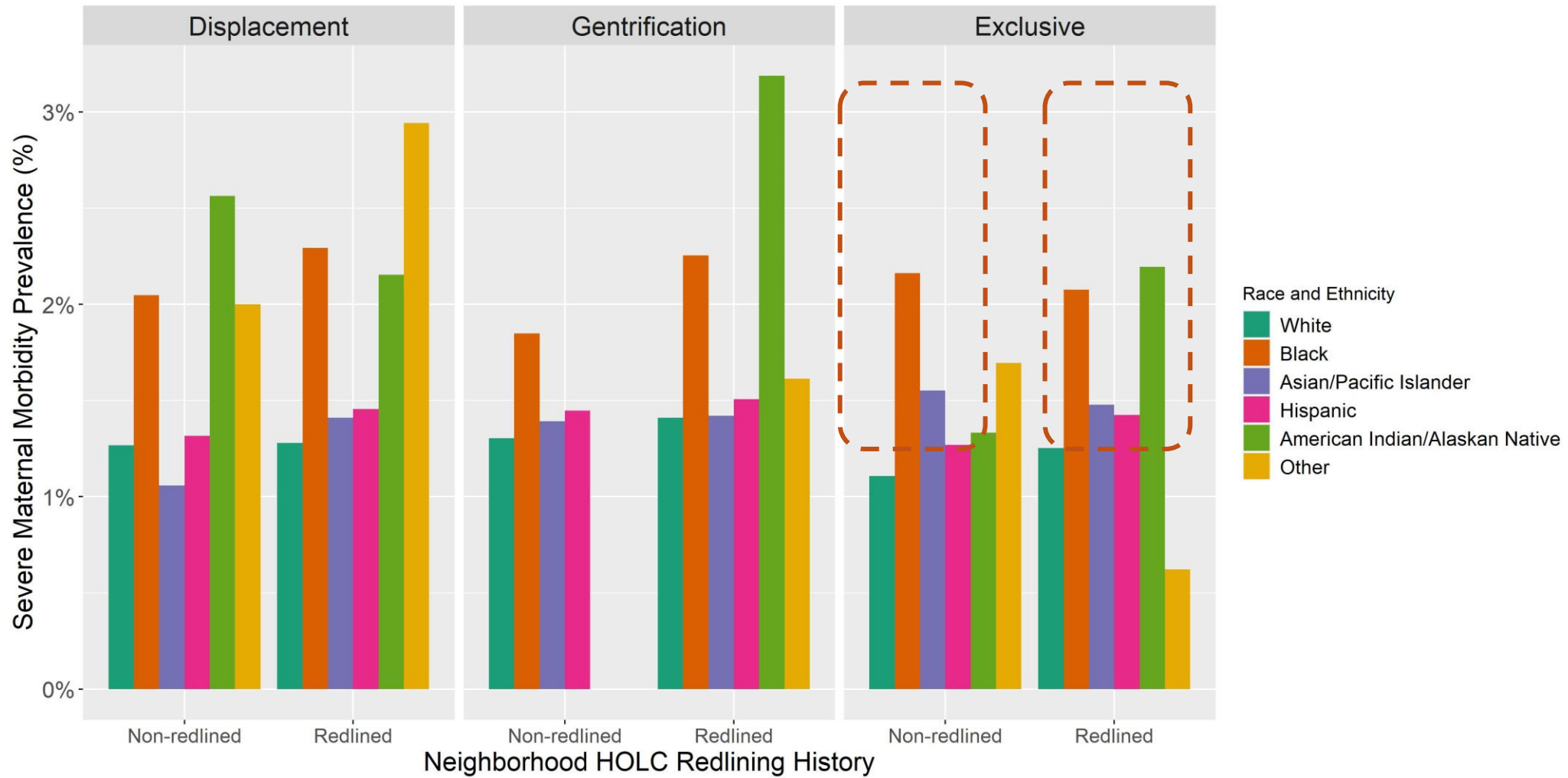




# Results



# Results



# Key Take-Away

- Findings demonstrate the importance of addressing past and present mechanisms that shape neighborhood social and material conditions to advance the well-being of birthing people in California.
- Future studies should examine other historical housing discrimination measures in combination with gentrification and utilize longitudinal data to investigate differential impact

# Published paper available open access at JAMA Network Open



Original Investigation | Equity, Diversity, and Inclusion

## Historical Redlining, Contemporary Gentrification, and Severe Maternal Morbidity in California, 2005-2018

Xing Gao, PhD; Rachel Morello-Frosch, PhD; Amani M. Nuru-Jeter, PhD; Jonathan M. Snowden, PhD; Suzan L. Carmichael, PhD; Mahasin S. Mujahid, PhD

### Abstract

**IMPORTANCE** Historically redlined neighborhoods may experience disinvestment, influencing their likelihood of gentrification, a process of neighborhood (re-)development that unequally distributes harms and benefits by race and class. Understanding the combined outcomes of redlining and gentrification informs how the mutually constitutive systems of structural racism and racial capitalism affect pregnancy outcomes.

**OBJECTIVE** To examine if historical redlining and contemporary gentrification is associated with increased severe maternal morbidity (SMM) odds.

**DESIGN, SETTING, AND PARTICIPANTS** This cross-sectional study used data from a statewide population-based sample of all live hospital births at 20 weeks' gestation or more between 2005 and 2018 in California. Analysis was conducted from March 2023 to January 2024.

**EXPOSURE** Redlining (as characterized by the federal Home Owners' Loan Corporation mortgage security maps) and displacement (using present-day sociodemographic and housing market information).

### Key Points

**Question** Is living in a historically redlined neighborhood currently experiencing gentrification associated with the odds of experiencing severe maternal morbidity (SMM)?

**Findings** In this cross-sectional study of a population-based sample of all live hospital births in California, living in a historically redlined neighborhood that currently experiences either displacement or gentrification was associated with greater odds of SMM for birthing people compared with residency in continuously advantaged neighborhoods.

