The Differential Impact of Residential Segregation on Gestational Hypertension Development Among Minority Women

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Background

- **Residential Segregation:** "extent to which individuals of different groups occupy or experience different social environments"[1]
  - Spatial manifestation of **entrenched racial and economic inequalities**[2]
  - **Fundamental cause of health disparities** in the United States

- Higher levels of segregation by race/ethnicity and socioeconomic position have been associated **adverse pregnancy outcomes**, **poorer cardiometabolic health**, and **incident CVD** development[3-9]

- Sizeable racial/ethnic **disparities persist** in cardiometabolic disturbance across the female life course, yet it **remains unclear** whether racial or economic segregation may differentially impact gestational hypertension (gHTN) risk among an ethnically-diverse cohort of pregnant women
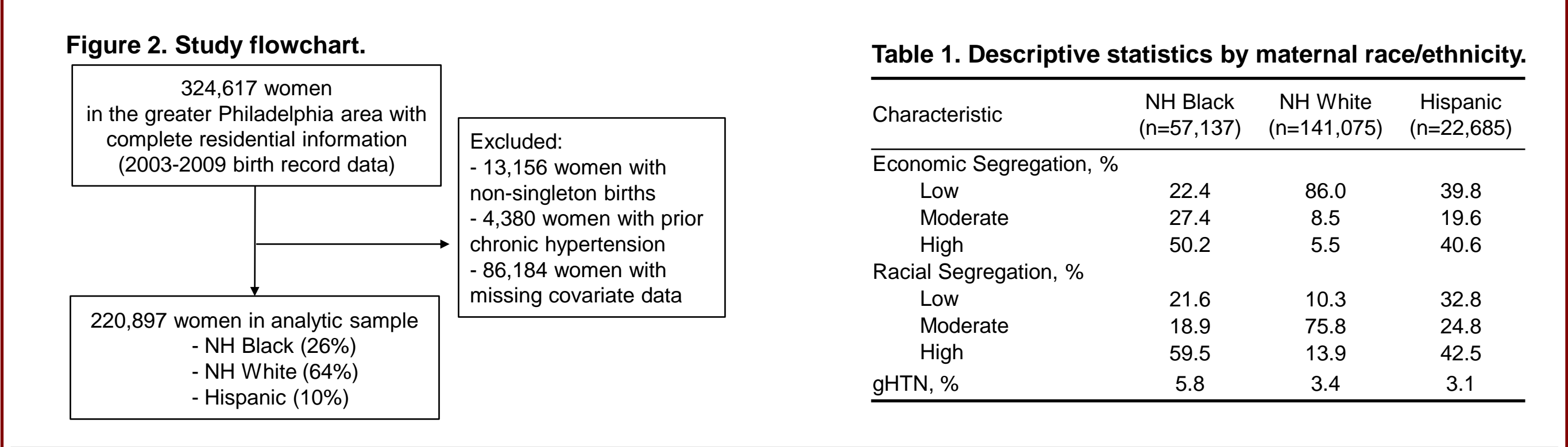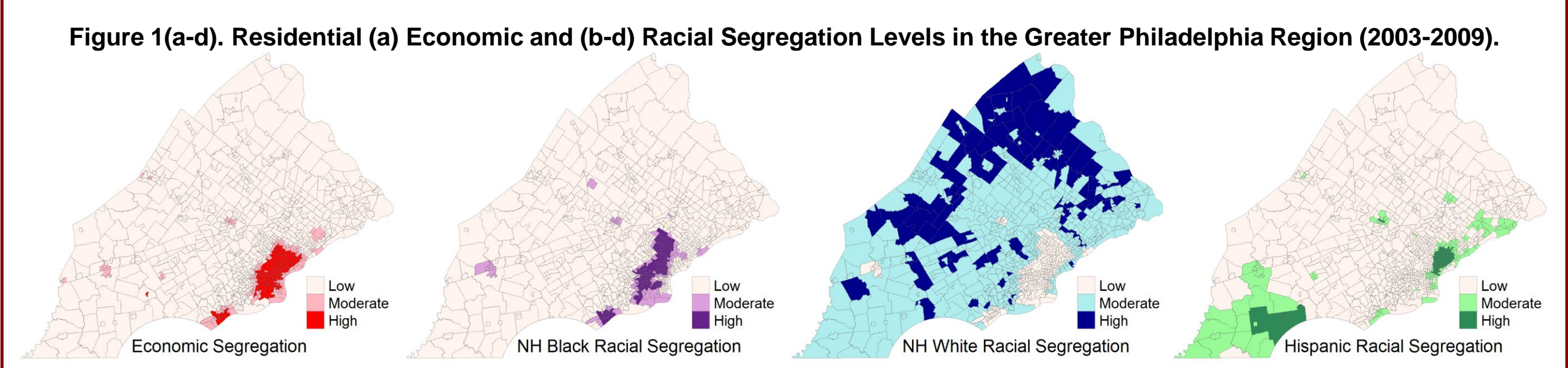
Objectives

- To create neighborhood-level measures of residential segregation using sociodemographic Census data and local spatial statistics

- To quantify the impact of racial and economic segregation on gHTN development among a diverse cohort of child-bearing women from the greater Philadelphia area using birth record data (2003-2009)

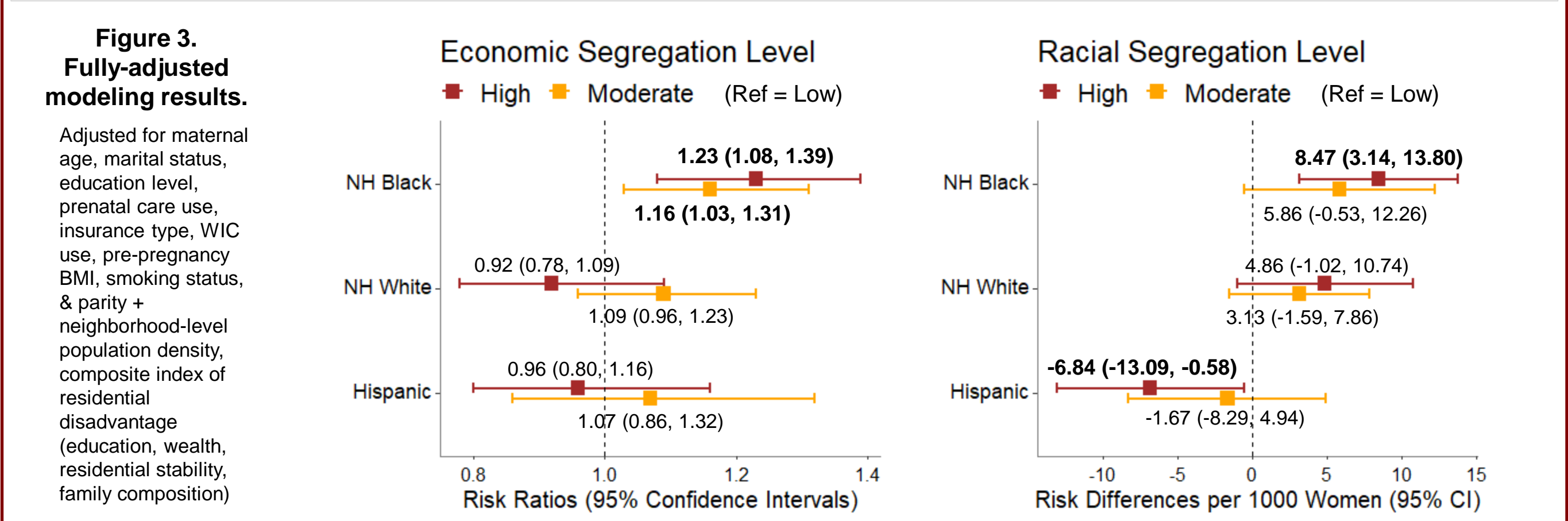- To determine whether this association differs by maternal race/ethnicity

Methods

- **Racial and economic segregation**: derived using the local Getis-Ord (Gi*) spatial statistic[10] based on racial composition and poverty data obtained from the 2000 US Census at the census tract-level
  - Gi* produces a spatially-weighted z-score for each census tract reflecting the degree of clustering of racially/economically similar neighborhoods in an area relative to the surrounding Philadelphia region
  - Categorized as low (Gi*<0), moderate (Gi*0-1.96), or high (Gi*>1.96), and assigned to each woman by her census tract of residence

- **Gestational hypertension**: diagnosis of pregnancy-induced hypertension or preeclampsia obtained from birth records

- Obtained risk ratios and risk differences (per 1000 women) for the relationships between each form of residential segregation and gHTN
  - Hierarchical generalized linear mixed effect models, stratified by maternal race/ethnicity, and adjusted for confounding factors

Results

Figure 1(a-d). Residential (a) Economic and (b-d) Racial Segregation Levels in the Greater Philadelphia Region (2003-2009).

Figure 2. Study flowchart.

Table 1. Descriptive statistics by maternal race/ethnicity.

Characteristic	NH Black (n=57,137)	NH White (n=141,075)	Hispanic (n=22,685)
Economic Segregation, %			
Low	22.4	86.0	39.8
Moderate	27.4	8.5	19.6
High	50.2	5.5	40.6
Racial Segregation, %			
Low	21.6	10.3	32.8
Moderate	18.9	75.8	24.8
High	59.5	13.9	42.5
gHTN, %	5.8	3.4	3.1

- NH Black women in moderate and high economic segregation areas had 16% higher risk (RR=1.16, 95% CI: 1.03-1.31) and 23% higher risk (RR=1.23, 95% CI: 1.08-1.39) of gHTN, respectively, compared to NH Black women living in low segregation areas.
- NH Black women in highly racially segregated neighborhoods saw an additional 9 cases of gHTN (per 1000 women) compared to NH Black women living in more racially integrated neighborhoods (RD=8.5, 95% CI: 3.1-13.8)
- Hispanic women living in highly racially segregated neighborhoods experienced 7 fewer cases of gHTN (per 1000 women) compared to those in more racially integrated neighborhoods (RD= -6.8, 95% CI: -13.1, -0.6)

Figure 3. Fully-adjusted modeling results.

Adjusted for maternal age, marital status, education level, prenatal care use, insurance type, WIC use, pre-pregnancy BMI, smoking status, & parity + neighborhood-level population density, composite index of residential disadvantage (education, wealth, residential stability, family composition)

Discussion

Higher levels of residential segregation were associated with greater risk of gHTN development among NH Black women in the greater Philadelphia region, after full adjustment.

- Consistent with prior evidence in related literature[3-9]
  - NH Black women: ↑ Segregation = ↓ Cardiometabolic health
  - NH White women: ↑ Segregation ≠ / = ↑ Cardiometabolic health
  - Hispanic women: Segregation ≠ / ? Cardiometabolic health

- Specific mechanisms unclear: likely multi-factorial
  - **Deprivation of health-promoting neighborhood resources:** healthy food options, safe physical activity spaces
  - **Exposure to health-harming neighborhood sources:** poor housing quality, pollution
  - **Persistent stress exposure to neighborhood & institutional stressors:** concentrated poverty, discrimination, racism

- Future work must be done to better **delineate the specific pathways** by which residential segregation differentially impacts cardiometabolic health based upon race
  - Incorporate more specific features of the neighborhood food and built environment which are associated with segregation, but may be more amenable to modification and intervention
  - Study length of residence within a given neighborhood on change in cardiometabolic risk progression across female life-course
  - Investigate whether social cohesion confers cardioprotection in reproductive-age women in different populations and settings (e.g. among Hispanic/Latino communities across the US)

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