

Racial inequities in self-rated health across Brazilian cities: does residential segregation play a role?

Joanna MN Guimarães, Ana V Diez-Roux, Sharrelle Barber, Goro Yamada, Waleska T Caiaffa, Mariana C Menezes,
Gervasio Santos, Isabel Santos, Amelia AL Friche, Leticia O Cardoso

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Background & Rationale

- **Black and Brown people represent historically marginalized social groups in Brazil**
- **Racial health inequities may be partially explained by area-level factors such as residential segregation**
- **Blacks and browns in Brazil are more likely to live in spatially segregated neighborhoods**
- **Studies on racial health inequities are scarce in Latin American countries**

Aims

- To investigate:

1. Differences in SRH by race in 27 Brazilian capital cities

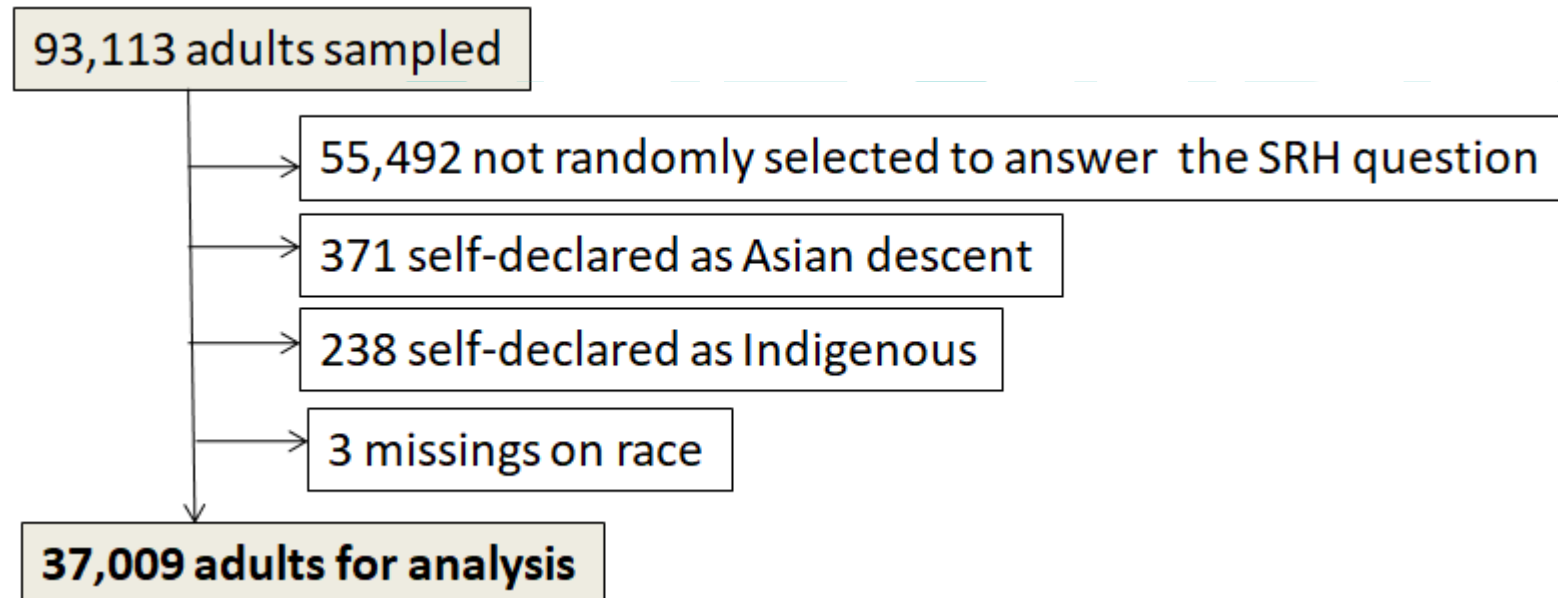
H1: Black and Brown people in Brazilian cities have poorer SRH than White people

2. Whether city-level economic and/or racial residential segregation interact with race, increasing racial inequities in SRH

H2: Cities with more income/racial segregation have larger SRH inequities by race

Methods – Study design and sample

- Cross-sectional study, data from the Brazilian National Health Survey (PNS – Pesquisa Nacional de Saúde)
- Representative sample of Brazilian adults (≥ 18 y)



Methods - Measures

- Exposure

Self-declared race/skin color: **White, Brown (or Pardo, proxy for Black and White admixture), Black, Asian, Indigenous**

- Outcome

Self-rated health (SRH): “In general, how would you rate your health?”

1. Very good

2. Good

3. Fair

4. Poor

5. Very poor



1. Very good/Good

2. Fair/Poor/Very poor

Methods - Measures

- Effect modifier

Residential segregation (economic and racial) – Dissimilarity index (Brazilian 2010 Census), in tertiles **Low, Medium, High**

- Formula:

$$\frac{1}{2} \sum_{i=1}^n \left| \frac{a_i}{A_T} - \frac{b_i}{B_T} \right|$$

Where:

- . n is the number of census tracts
- . A_T is the % of households with mean income ≤ 2 minimum wages, or the % of Black and Brown people, in the city
- . B_T is the % of households with mean income > 2 minimum wages, or the % of White people, in the city
- . a_i and b_i are their respective populations in census tract i

- Measures evenness and indicates the % of a population group that would have to be relocated in order to achieve complete integration

Methods - Measures

- **Covariates**

Individual age, sex and education

City-level Social environment index: Z scores of city features including the % of the pop ≥ 25 who completed primary education or above, % of households with access to piped water, % of households with access to a sewage network, % of households with >3 people/room (Bilal et al 2021)

Methods – Statistical analysis

- **Multilevel logistic regression models (individuals nested within cities)**
- **Random intercept for each city and robust variance estimation**
- **Prevalence ratios and Prevalence differences using the marginal standardization method (based on predicted probabilities of Fair/Poor SRH)**

Methods – Statistical analysis

- Models were run separately for economic and racial segregation:

Model 1: adjusted for age and sex

Model 2: + education

Model 3: + social environment index

Model 4A: + economic segregation

Model 4B: + racial segregation

Model 5A: + race* economic segregation

Model 5B: + race* racial segregation

Methods – Statistical analysis

We derived:

- **Adjusted marginal prevalences** of Fair/Poor SRH, for each race group (White, Brown and Black) stratified by levels of segregation (low, medium, high)
- **Adjusted Prevalence ratios** and **Prevalence differences** for Black and Brown participants, compared to White participants, by levels of segregation

Results



Table 1. Characteristics of the sample by SRH. National Health Survey (PNS), Brasil 2013.

	All	Self-rated health		
		Good or Better	Fair/Poor	p-value
Number of participants (%)	37,009	25,357 (68.5)	11,652 (31.5)	-
Race/skin color, %				
White	41.6	72.7	27.3	< 0.001
Brown	48.2	66.0	34.0	
Black	10.2	63.6	36.4	
Age in years, mean (SD)	43.1 (16.5)	40.1 (15.3)	49.6 (17.0)	< 0.001
Sex, male %	41.9	44.4	36.4	< 0.001
Education, %				
University	14.9	18.5	7.3	< 0.001
Secondary	37.3	42.1	26.7	
Primary	23.4	22.8	24.6	
Less than Primary	24.4	16.6	41.4	
City-level social environment index*	0.01	0.03 (0.49)	-0.04 (0.50)	< 0.001
* Higher score indicates better social environment				

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Table 2. Characteristics of the sample by economic segregation in tertiles. National Health Survey (PNS), Brasil 2013.

	Income residential segregation ¹			
	Low (0.26-0.30)	Medium (0.31-0.33)	High (0.34-0.41)	P-value
Number of participants (%)	13,315 (36.0)	11,357 (30.7)	12,337 (33.3)	-
Fair/Poor self-rated health, %	29.6	30.5	34.4	< 0.001
Race/skin color, %				
White	47.8	41.5	35.2	< 0.001
Brown	45.2	48.3	51.2	
Black	7.0	10.2	13.6	
Age in years, mean (SD)	42.1 (16.2)	43.6 (16.6)	43.7 (16.6)	< 0.001
Sex, male %	43.7	40.9	40.7	< 0.001
Education, %				
University	14.8	14.9	15.2	0.04
Secondary	37.9	37.0	36.8	
Primary	23.9	23.2	22.9	
Less than Primary	23.5	24.8	25.0	
City-level social environment index*	-0.18 (0.63)	0.11 (0.38)	0.12 (0.36)	< 0.001
¹ Household income-based dissimilarity index: ≤2 minimum wages vs others				
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Table 3. Characteristics of the sample by racial segregation in tertiles. National Health Survey (PNS), Brasil 2013.

	Racial residential segregation ²			P-value
	Low (0.13-0.21)	Medium (0.22-0.29)	High (0.30-0.34)	
Number of participants (%)	12,895 (35.0)	12,356 (33.4)	11,758 (31.8)	-
Fair/Poor self-rated health, %	35.7	29.2	29.2	< 0.001
Race/skin color, %				
White	26.3	41.8	58.2	< 0.001
Brown	65.4	47.6	30.0	
Black	8.3	10.6	11.8	
Age in years, mean (SD)	41.3 (16.0)	42.9 (16.3)	45.2 (17.0)	< 0.001
Sex, male %	41.8	42.1	41.6	0.67
Education, %				
University	11.0	17.8	16.4	< 0.001
Secondary	38.1	36.9	36.8	
Primary	24.5	22.6	22.9	
Less than Primary	26.4	22.7	23.9	
City-level social environment index*	-0.54 (0.39)	0.19 (0.26)	0.42 (0.10)	< 0.001
² Race-based dissimilarity index: % of blacks and browns combined vs % of whites				
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Table 4. Marginal prevalence ratios (PR) and marginal prevalence differences (PD) of Fair/Poor SRH associated with race and residential segregation (in tertiles). National Health Survey (PNS), Brasil 2013.

	M1: + age and sex	M2: + education	M3: + SEI	M4A: + income seg	M4B: + racial seg
Prevalence Ratios (PR)					
Brown (vs White)	1.25 (1.19,1.33)	1.12 (1.07,1.17)	1.12 (1.07,1.17)	1.11 (1.07,1.16)	1.12 (1.07,1.17)
Black (vs White)	1.34 (1.26,1.42)	1.18 (1.12,1.23)	1.18 (1.13,1.24)	1.18 (1.12,1.23)	1.18 (1.13,1.24)
Residential segregation, medium (vs low)				1.08 (0.96,1.22)	0.97 (0.81,1.16)
Residential segregation, high (vs low)				1.18 (1.04,1.32)	1.07 (0.86,1.33)
Prevalence Differences (PD)					
Brown (vs White)	0.07 (0.06,0.09)	0.03 (0.02,0.05)	0.03 (0.02,0.05)	0.03 (0.02,0.05)	0.03 (0.02,0.05)
Black (vs White)	0.09 (0.08,0.11)	0.05 (0.04,0.07)	0.05 (0.04,0.07)	0.05 (0.04,0.07)	0.05 (0.04,0.07)
Residential segregation, medium (vs low)				0.02 (-0.01,0.06)	-0.01 (-0.06,0.04)
Residential segregation, high (vs low)				0.05 (0.01,0.09)	0.02 (-0.05,0.09)

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Figures 1a and 1b. Adjusted marginal prevalences of Fair/Poor SRH by residential segregation in tertiles (economic and racial) and race. National Health Survey (PNS), Brasil 2013.

Fig 1a. Income residential segregation (in tertiles)

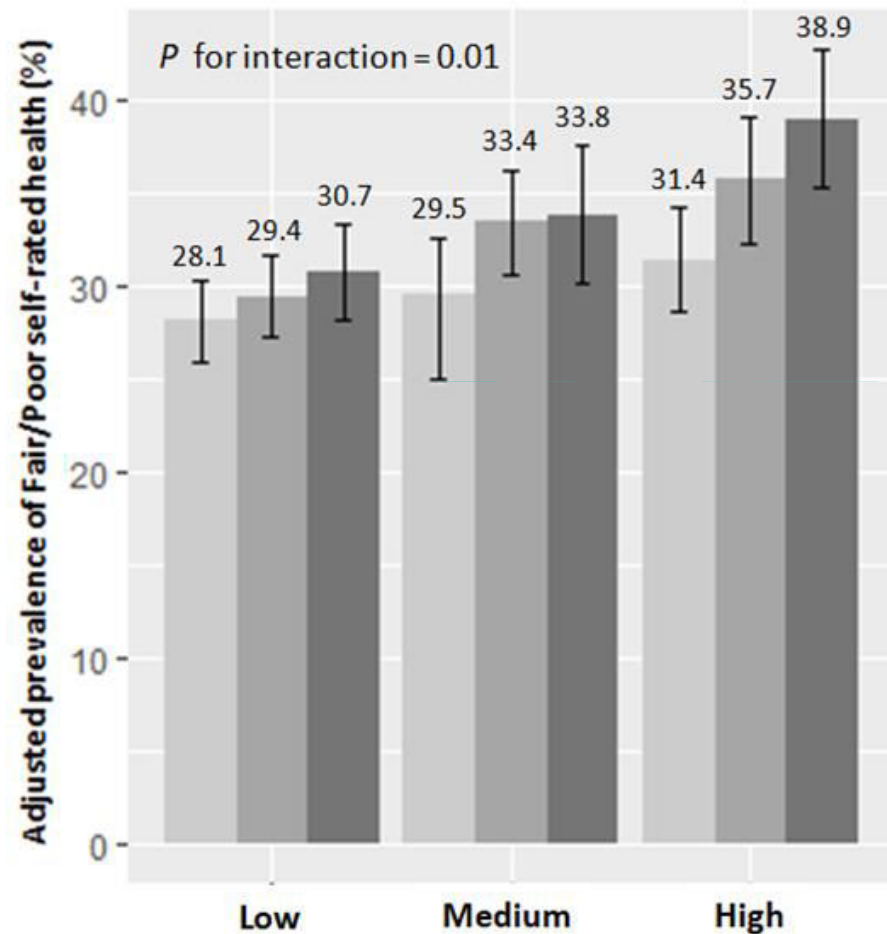
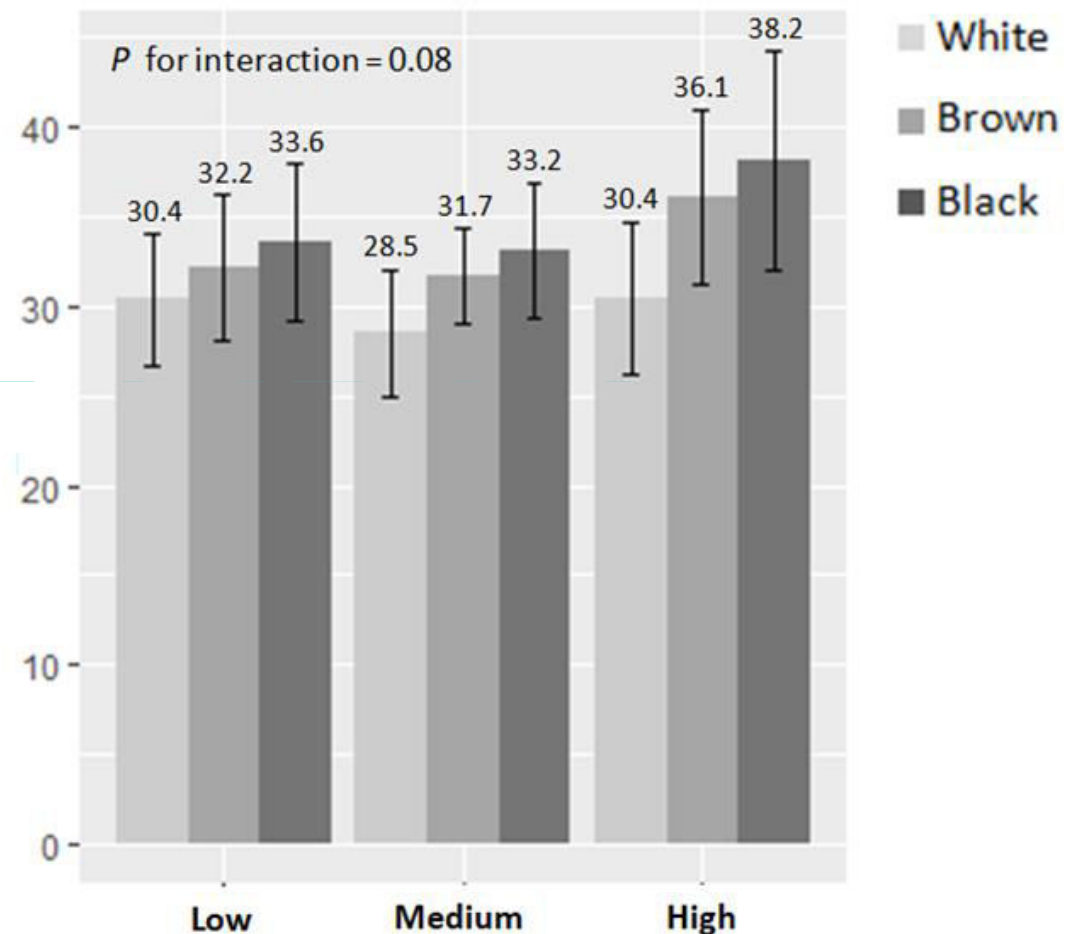


Fig 1b. Racial residential segregation (in tertiles)



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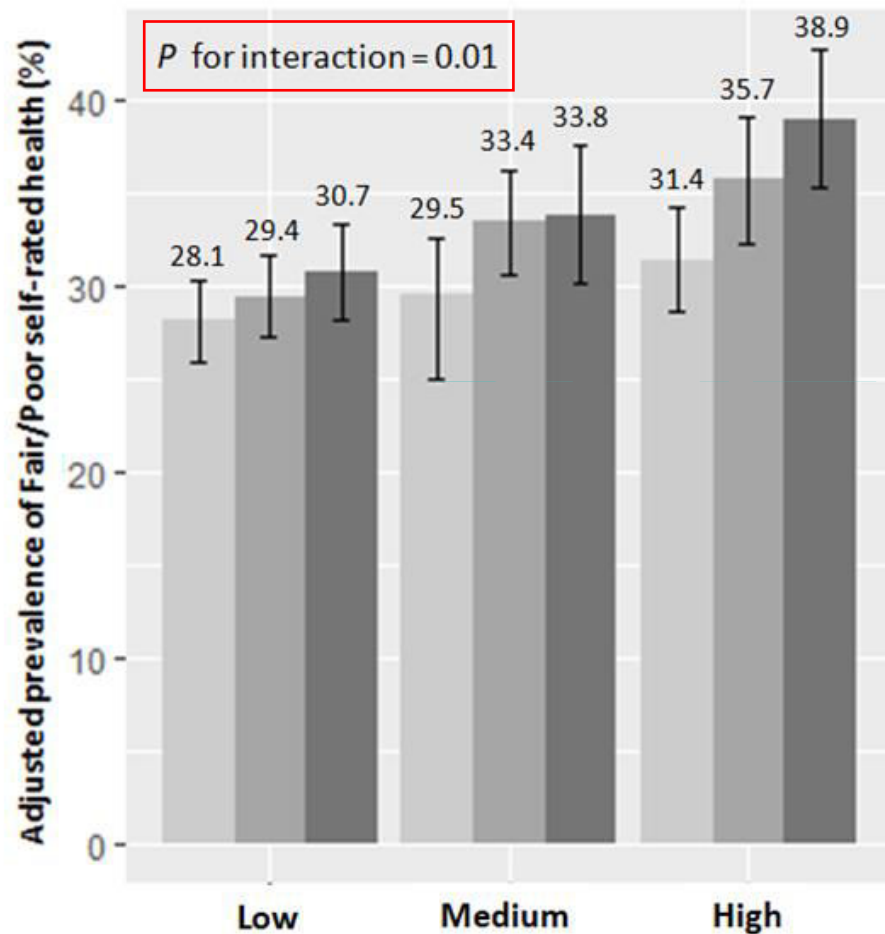


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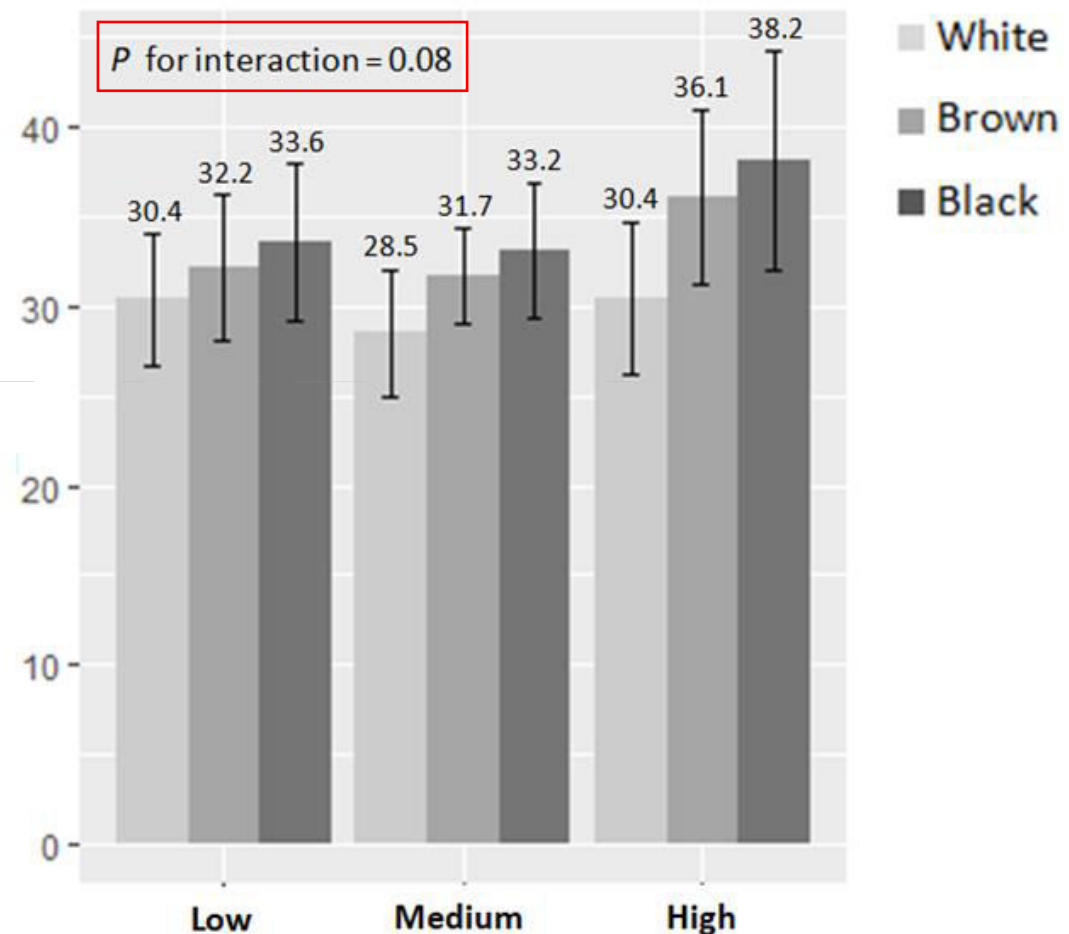


Table 5. Marginal prevalence ratios (PR) and marginal prevalence differences (PD) of Fair/Poor SRH associated with race and residential segregation (in tertiles). National Health Survey (PNS), Brasil 2013.

	M5A: + race*income segregation	M5B: + race*racial segregation
Prevalence Ratios (PR)		
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at Low residential segregation	1.05 (0.98,1.12)	1.06 (1.00,1.12)
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Black (vs White)		
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at High residential segregation	0.04 (0.02,0.06)	0.06 (0.04,0.08)
Black (vs White)		
at Low residential segregation	0.03 (0.01,0.05)	0.03 (0.01,0.05)
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Final remarks

- **Black and Brown people showed higher prevalence of Fair/Poor SRH than White people**
- **Residential segregation interacted with race, such that racial inequities in SRH were larger in more segregated compared to less segregated cities**

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