SCIENCE IN SOCIETY:

"Discrimination, Segregation, and Chronic Inflammation: Testing the Weathering Explanation for the Poor Health of Black Americans" (Simons et al. 2018)

CONTEXT

- Black Americans have a greater prevalence of chronic illness and a significantly lower life expectancy than other ethnic groups
  - Black adults are 50% more likely to have a stroke than white adults
  - Black adults are 40% more likely to have high blood pressure than white adults
  - Black adults are 20% more likely to die from heart disease than white adults

- Current health interventions involve improving socioeconomic status or health risk behaviors in Black populations to improve health outcomes, **but middle and upper-class Black Americans still have high rates of chronic illness and disability**

- While these strategies have been shown to improve the health outcomes of some populations, they do not eliminate health disparities faced by Black populations

Source: US Department of Health and Human Services Office of Minority Health. Profile: Black/African Americans 2019. https://minorityhealth.hhs.gov/omh/browse.aspx?lvl=3&lvlid=61

DEFINITIONS:

- **Health Disparities:** Preventable differences in the burden of disease injury, violence, or opportunities to achieve optimal health that are experienced by socially disadvantaged populations

- **Health Inequity:** Differences in the burden of disease, injury, violence, or opportunities to achieve optimal health that are **unnecessary, avoidable, and unfair**

- **Weathering Hypothesis:** "The elevated rates of illness and disability seen among Black Americans is a physiological response to the structural barriers and daily slights, stereotypes, and other threats to one's identity that comprise the Black experience"

- **The PAR Model:** Early adolescence is a sensitive period, during which cognitive and biological systems are programmed to prepare the organism for their future environment.

- **The Cumulative Stress Model:** Individuals are at their greatest physiological risk when exposed to chronic or cumulative stress across a lifetime.

- **The Stress Generation Model:** The more immediate stress levels in previous months or years are the best predictors of physiological stress.

OVERVIEW

- Currently used "health risk factors" are inaccurate when addressing health disparities observed in Black populations

  - Socioeconomic status and even changes in health risk behaviors such as smoking and diet do not attribute to the large distribution gap of chronic illness between races

- Exposure to racism, discrimination, and segregation may be a stronger contributor to poor health outcomes in Black populations

  - In this study, chronic inflammation is used as an indicator for health outcomes

- Used data from the Family and Community Health Study and performed longitudinal study: Started with a sample of 889 children in 5th grade, and followed the cohort in 7 waves until the age of 28, where 479 individuals remained to give blood.

- Included measurements of 14 cytokines

INITIAL THOUGHTS?

RESULTS

- After controlling for "health risk behaviors" and socioeconomic status, exposure to racial discrimination and/or racial segregation leads to an increased risk of chronic inflammation

- Alternatively, socioeconomic status showed no association with increased risk of chronic inflammation

- Exposure to racial discrimination and segregation in childhood showed the most significant risk. No exposure in childhood, with later exposure in adulthood showed no significant risk. If exposed in childhood, exposure in adulthood compounds risk.

Zero-Order Correlations between Racial Discrimination/Racial Segregation and Inflammation at each wave:

- Racial discrimination is significantly correlated with inflammation at every age

- Racial segregation is significantly correlated with inflammation at every age

- Researchers separated cohort waves into two group for further analysis: Waves 1-3-Adolescents, Waves 4-6- Adults

Table 1
Correlations of Racial Discrimination/Racial Segregation and Inflammation (n = 409)

Racism variables	r	p value
Racial discrimination		
Age 10	.135	.006
Age 13	.163	.001
Age 15	.174	.000
Age 18	.109	.027
Age 21	.137	.006
Age 24	.158	.001
Racial segregation		
Age 10	.190	.000
Age 13	.189	.000
Age 15	.241	.000
Age 18	.159	.001
Age 21	.188	.000
Age 24	.202	.000

Correlations between Observed Variables and Inflammation:

Table 2
Correlations, Means, and Standard Deviations Among the Study Variables (n = 409)

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Inflammation	—														
2. Juvenile racial discrimination	.192**	—													
3. Adult racial discrimination	.158**	.576**	—												
4. Juvenile racial segregation	.219**	.279**	.289**	—											
5. Adult racial segregation	.199**	.240**	.251**	.866**	—										
6. Males	−.083†	−.018	.150**	−.106*	−.062	—									
7. Acute illness (age 28)	.121*	.199**	.255**	.253**	.243**	−.243**	—								
8. Education (age 28)	.045	−.008	.037	.099*	.116*	−.066	.064	—							
9. Income (age 28)	.050	−.041	.052	−.041	−.013	.100*	.037	.245**	—						
10. Married or cohabiting (age 28)	.065	−.061	.002	.054	.062	.007	.041	.076	.172**	—					
11. Health insurance (age 28)	.070	−.012	−.016	.070	.087†	−.120*	.156**	.211**	.141**	.057	—				
12. Healthy diet (ages 18–28)	.088†	.147**	.031	−.018	−.030	−.168**	.037	.154**	−.043	.025	.092†	—			
13. Exercise (ages 18–28)	.097*	.186**	.181**	.089†	.094†	.292**	.007	.138**	.104*	−.021	.040	.254**	—		
14. Alcoholic drinks (ages 18–28)	.085†	.206**	.304**	.242**	.233**	.164**	.202**	.076	.113*	−.046	.042	−.091†	.045	—	
15. Cigarette use (ages 18–28)	.046	.189**	.200**	.148**	.123*	.077	.072	−.295**	−.086†	−.064	−.060	−.114*	.024	.333**	—
M	3.737	21.474	21.268	.795	.802	.380	5.303	13.095	479.269	.259	.822	6.044	4.896	2.037	1.938
SD	.778	5.868	6.244	.179	.157	.486	6.404	1.755	509.659	.439	.383	1.650	1.433	.972	1.314

† $p \leq .10$.　* $p \leq .05$.　** $p \leq .01$ (two-tailed tests).

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- Discrimination and segregation are both correlated with inflammation

- Juvenile discrimination and segregation are correlated with Adult discrimination and segregation

Correlations between Observed Variables and Inflammation:

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† p ≤ .10. * p ≤ .05. ** p ≤ .01 (two-tailed tests).

Other variables commonly used as health interventions were not significantly correlated with inflammation

Juvenile discrimination/segregation impacts risk of adult inflammation:

Table 3

Regression Coefficients and Standard Errors for Racial Discrimination and Racial Segregation Regressed on Inflammation

| | Racial discrimination | | | | | | Racial resident segregation | | | | | |
| | Model 1A | | Model 1B | | Model 1C | | Model 2A | | Model 2B | | Model 2C | |
Predictors and controls	b	β	b	β	b	β	b	β	b	β	b	β
Juvenile racial discrimination	.020 (.007)**	.154			.016 (.008)*	.121						
Adult racial discrimination			.016 (.007)*	.130	.008 (.008)	.064						
Juvenile racial segregation							.798 (.270)**	.182			.696 (.291)*	.154
Adult racial segregation									.800 (.367)*	.162	.136 (.439)	.032
Males	−.158 (.090)†	−.099	−.198 (.091)*	−.124	−.175 (.091)†	−.109	−.118 (.068)†	−.081	−.137 (.066)*	−.092	−.119 (.067)†	−.082
Acute illness	.005 (.006)	.043	.004 (.007)	.035	.004 (.007)	.033	.005 (.003)	.037	.006 (.003)†	.039	.005 (.003)	.036
Education (age 28)	−.001 (.024)	−.001	−.003 (.024)	−.007	−.001 (.024)	−.003	−.009 (.018)	−.021	−.008 (.019)	−.021	−.009 (.018)	−.022
Income (age 28)	.001 (.001)	.035	.001 (.001)	.028	.001 (.001)	.034	.001 (.001)	.048	.001 (.001)	.043	.001 (.001)	.048
Married or cohabiting (age 28)	.124 (.088)	.070	.111 (.088)	.063	.120 (.088)	.068	.083 (.072)	.050	.086 (.071)	.051	.082 (.072)	.049
Health insurance (age 28)	.076 (.103)	.037	.076 (.103)	.037	.080 (.103)	.039	.038 (.116)	.027	.033 (.115)	.025	.037 (.116)	.027
Healthy diet (ages 18–28)	.014 (.025)	.029	.020 (.025)	.043	.014 (.025)	.030	.029 (.016)†	.062	.029 (.016)†	.062	.029 (.016)†	.063
Exercise (ages 18–28)	.045 (.030)	.083	.051 (.030)†	.094	.044 (.030)	.082	.045 (.021)*	.084	.048 (.021)*	.089	.045 (.021)*	.084
Alcoholic drinks (ages 18–28)	.042 (.044)	.052	.041 (.045)	.051	.036 (.045)	.045	.027 (.041)	.040	.033 (.042)	.047	.027 (.041)	.040
Cigarette use (ages 18–28)	.009 (.033)	.015	.012 (.033)	.020	.007 (.033)	.012	.009 (.041)	.017	.012 (.040)	.022	.009 (.042)	.018
Constant	2.806 (.358)**		2.901 (.355)**		2.775 (.360)**		2.678 (.377)**		2.650 (.413)**		2.655 (.403)**	
R-squared	.068		.061		.070		.075		.068		.075	

Note. Unstandardized (*b*) and standardized (β) coefficients shown with standard errors in parentheses; the standard error of racial segregation is adjusted for clustered at county-level (*n* = 52). *N* = 409.

† *p* ≤ .10.   * *p* ≤ .05.   ** *p* ≤ .01 (two-tailed tests).

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Acute illness	.005 (.006)	.043	.004 (.007)	.035	.004 (.007)	.033	.005 (.003)	.037	.006 (.003)†	.039	.005 (.003)	.036
Education (age 28)	−.001 (.024)	−.001	−.003 (.024)	−.007	−.001 (.024)	−.003	−.009 (.018)	−.021	−.008 (.019)	−.021	−.009 (.018)	−.022
Income (age 28)	.001 (.001)	.035	.001 (.001)	.028	.001 (.001)	.034	.001 (.001)	.048	.001 (.001)	.043	.001 (.001)	.048
Married or cohabiting (age 28)	.124 (.088)	.070	.111 (.088)	.063	.120 (.088)	.068	.083 (.072)	.050	.086 (.071)	.051	.082 (.072)	.049
Health insurance (age 28)	.076 (.103)	.037	.076 (.103)	.037	.080 (.103)	.039	.038 (.116)	.027	.033 (.115)	.025	.037 (.116)	.027
Healthy diet (ages 18–28)	.014 (.025)	.029	.020 (.025)	.043	.014 (.025)	.030	.029 (.016)†	.062	.029 (.016)†	.062	.029 (.016)†	.063
Exercise (ages 18–28)	.045 (.030)	.083	.051 (.030)†	.094	.044 (.030)	.082	.045 (.021)*	.084	.048 (.021)*	.089	.045 (.021)*	.084
Alcoholic drinks (ages 18–28)	.042 (.044)	.052	.041 (.045)	.051	.036 (.045)	.045	.027 (.041)	.040	.033 (.042)	.047	.027 (.041)	.040
Cigarette use (ages 18–28)	.009 (.033)	.015	.012 (.033)	.020	.007 (.033)	.012	.009 (.041)	.017	.012 (.040)	.022	.009 (.042)	.018
Constant	2.806 (.358)**		2.901 (.355)**		2.775 (.360)**		2.678 (.377)**		2.650 (.413)**		2.655 (.403)**	
R-squared	.068		.061		.070		.075		.068		.075	

Note. Unstandardized (b) and standardized (β) coefficients shown with standard errors in parentheses; the standard error of racial segregation is adjusted for clustered at county-level ($n = 52$).
$N = 409$.
† $p \leq .10$. * $p \leq .05$. ** $p \leq .01$ (two-tailed tests).

When effects are combined, we see that juvenile discrimination/segregation is significantly correlated with adult inflammation (supporting the PAR model)

Juvenile discrimination/segregation impacts risk of adult inflammation:

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Regression Coefficients and Standard Errors for Racial Discrimination and Racial Segregation Regressed on Inflammation

| Predictors and controls | Racial discrimination | | | | | | Racial resident segregation | | | | | |
| | Model 1A | | Model 1B | | Model 1C | | Model 2A | | Model 2B | | Model 2C | |
	b	β	b	β	b	β	b	β	b	β	b	β
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Acute illness	.005 (.006)	.043	.004 (.007)	.035	.004 (.007)	.033	.005 (.003)	.037	.006 (.003)†	.039	.005 (.003)	.036
Education (age 28)	−.001 (.024)	−.001	−.003 (.024)	−.007	−.001 (.024)	−.003	−.009 (.018)	−.021	−.008 (.019)	−.021	−.009 (.018)	−.022
Income (age 28)	.001 (.001)	.035	.001 (.001)	.028	.001 (.001)	.034	.001 (.001)	.048	.001 (.001)	.043	.001 (.001)	.048
Married or cohabiting (age 28)	.124 (.088)	.070	.111 (.088)	.063	.120 (.088)	.068	.083 (.072)	.050	.086 (.071)	.051	.082 (.072)	.049
Health insurance (age 28)	.076 (.103)	.037	.076 (.103)	.037	.080 (.103)	.039	.038 (.116)	.027	.033 (.115)	.025	.037 (.116)	.027
Healthy diet (ages 18–28)	.014 (.025)	.029	.020 (.025)	.043	.014 (.025)	.030	.029 (.016)†	.062	.029 (.016)†	.062	.029 (.016)†	.063
Exercise (ages 18–28)	.045 (.030)	.083	.051 (.030)†	.094	.044 (.030)	.082	.045 (.021)*	.084	.048 (.021)*	.089	.045 (.021)*	.084
Alcoholic drinks (ages 18–28)	.042 (.044)	.052	.041 (.045)	.051	.036 (.045)	.045	.027 (.041)	.040	.033 (.042)	.047	.027 (.041)	.040
Cigarette use (ages 18–28)	.009 (.033)	.015	.012 (.033)	.020	.007 (.033)	.012	.009 (.041)	.017	.012 (.040)	.022	.009 (.042)	.018
Constant	2.806 (.358)**		2.901 (.355)**		2.775 (.360)**		2.678 (.377)**		2.650 (.413)**		2.655 (.403)**	
R-squared	.068		.061		.070		.075		.068		.075	

Note. Unstandardized (b) and standardized (β) coefficients shown with standard errors in parentheses; the standard error of racial segregation is adjusted for clustered at county-level (n = 52).
N = 409.
† p ≤ .10. * p ≤ .05. ** p ≤ .01 (two-tailed tests).

When effects are combined, we see that juvenile discrimination/segregation is significantly correlated with adult inflammation (supporting the PAR model)

Composite juvenile discrimination/segregation impacts risk of adult inflammation:

Table 4

Regression Coefficients and Standard Errors for Composite Racism Regressed on Inflammation

Predictors and controls	Model 3A b	Model 3A β	Model 3B b	Model 3B β	Model 3C b	Model 3C β	Model 3D b	Model 3D β
Juvenile composite racism	.217** (.052)	.223			.177* (.076)	.181	.168* (.078)	.172
Adult composite racism			.197** (.053)	.200	.078 (.078)	.080	.069 (.080)	.070
Males	−.129 (.089)	−.080	−.180* (.089)	−.112	−.107 (.081)	−.067	−.142 (.091)	−.088
Acute illness	.003 (.006)	.022	.002 (.007)	.014	.003 (.006)	.029	.002 (.007)	.014
Education (age 28)	−.007 (.024)	−.015	−.010 (.024)	−.022			−.008 (.024)	−.019
Income (age 28)	.001 (.001)	.049	.001 (.001)	.039			.001 (.001)	.048
Married or cohabiting (age 28)	.104 (.087)	.058	.094 (.087)	.053			.099 (.087)	.056
Health insurance (age 28)	.070 (.102)	.034	.067 (.102)	.033			.070 (.102)	.034
Healthy diet (ages 18–28)	.020 (.025)	.042	.025 (.025)	.053			.021 (.025)	.045
Exercise (ages 18–28)	.036 (.030)	.067	.043 (.030)	.079			.036 (.030)	.066
Alcoholic drinks (ages 18–28)	.022 (.044)	.028	.023 (.045)	.029			.018 (.045)	.022
Cigarette use (ages 18–28)	.002 (.033)	.003	.006 (.033)	.010			.001 (.033)	.002
Constant	3.392** (.350)		3.393** (.354)		3.760** (.064)		3.430** (.353)	
R-squared		.087		.078		.074		.089

Note. Unstandardized (b) and standardized (β) coefficients shown with robust standard errors in parentheses. N = 409.
* $p \leq .05$. ** $p \leq .01$ (two-tailed tests).

Composite juvenile racism impacts risk of adult inflammation:

Table 4
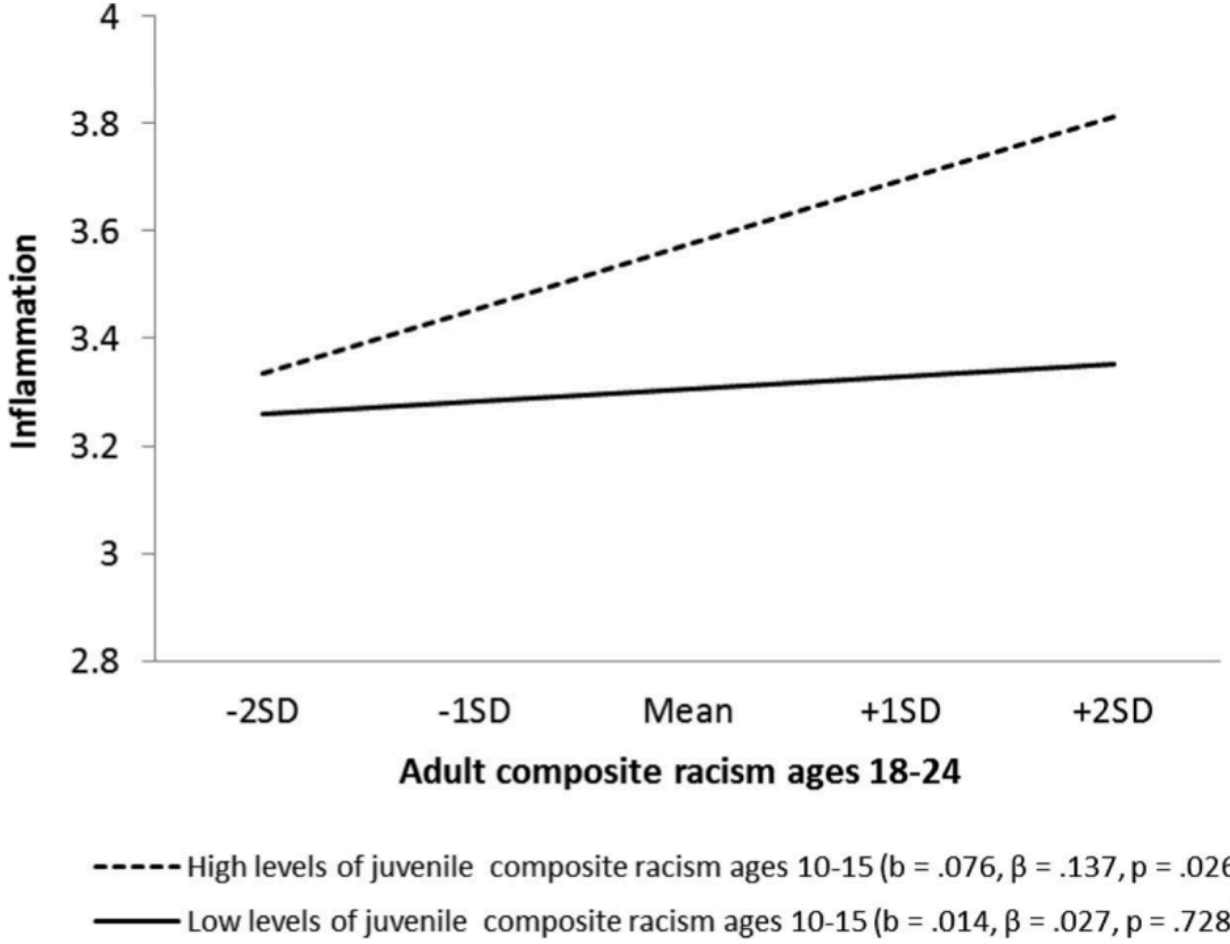### Regression Coefficients and Standard Errors for Composite Racism Regressed on Inflammation

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Married or cohabiting (age 28)	.104 (.087)	.058	.094 (.087)	.053			.099 (.087)	.056
Health insurance (age 28)	.070 (.102)	.034	.067 (.102)	.033			.070 (.102)	.034
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R-squared		.087		.078		.074		.089

Note. Unstandardized (b) and standardized (β) coefficients shown with robust standard errors in parentheses. N = 409.
*p ≤ .05. **p ≤ .01 (two-tailed tests).

When segregation and discrimination are combined to define "racism", similar effects are still observed (even after controlling for SES variables)

Composite juvenile racism increases risk of adult inflammation:

Y-axis: Inflammation (2.8, 3, 3.2, 3.4, 3.6, 3.8, 4)

X-axis: Adult composite racism ages 18-24 (-2SD, -1SD, Mean, +1SD, +2SD)

- - - - - High levels of juvenile composite racism ages 10-15 (b = .076, β = .137, p = .026)
——— Low levels of juvenile composite racism ages 10-15 (b = .014, β = .027, p = .728)

DISCUSSION

- Framing health inequality: after reading through this paper, how do you think we can better address "health disparities"?

  - How can we include racial inequality into future conversation and analysis?

- What would we expect to see if this study continued beyond late 20s?

- Let's consider the potential compounding effect of being Black and transgender or Black and a woman, what additional experiences/exposures might impact their health risks?