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Overall Goals

- Chronic inflammation is a public health concern
- Social processes are consequential for inflammation and for disparities in inflammation

What is Inflammation?
**What is Inflammation?**

- Immune response to:
  - Injury
  - Infection
  - Threatening, challenging, or stressful situation
- Symptoms
  - Pain, redness, swelling, increased temperature
- Preemptive inflammatory response during times of stress
- Typically short-lived (i.e., acute)

**What is Chronic Inflammation?**

- Persistent, low-level inflammation
- Systemic vs. localized
- Asymptomatic
Determinants of Chronic Inflammation

- Age
- Adverse health behaviors
- Waist circumference, Body mass index (BMI)
- Environmental pollutants
- Psychological conditions and stress exposure (e.g., discrimination)
- Socioeconomic status (e.g., education)
The Current Study

Research Questions

1. Are there race/ethnic differences in inflammation?
2. If so, are race/ethnic differences in inflammation explained by differences in education?
### The Health and Retirement Study (HRS)
- Nationally representative survey of adults age 51 and older
- Biomarker and physical assessments started in 2006 with random half-sample
- Pooled data from 2006 and 2008
- \( N = 11,935 \)

### Key Variables
- **Race/Ethnicity**
  - African American
  - Hispanic
  - Non-Hispanic White (ref.)
- **C-reactive protein (CRP)**
  - General marker of inflammation
  - Log-transformed
- **Education (years)**
Additional Covariates

- Demographic characteristics
  - Age (years)
  - Gender (ref. = males)
  - Marital status (married, separated/divorced, widowed, never)

- Socioeconomic factors
  - Household income (log-transformed)
  - Employment status (employed, retired, other)

- Health behaviors
  - Smoking (never, former, current)
  - Alcohol (non-drinker, moderate, heavy)
  - Physical activity (no activity, ≤ 1/week, > 1/week)
    - Vigorous and moderate

- Health status
  - Waist circumference (inches)
  - Body Mass Index; BMI (kg/m²)
  - Depressive symptoms; CES-D (range: 0-8)

Analytical Procedures

- Nested linear regression models
  1. Race/Ethnicity, Gender, Age, Marital Status
  2. … + Education
  3. … + Income, Employment Status
  4. … + Health Behaviors
  5. … + BMI, Waist, Depressive Symptoms
### Table 1 - Select Characteristics of the Sample (n=11,935)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Mean (SD) or %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Race (%)</strong></td>
<td></td>
</tr>
<tr>
<td>Non-Hispanic white</td>
<td>77.6</td>
</tr>
<tr>
<td>African American</td>
<td>13.1</td>
</tr>
<tr>
<td>Hispanic</td>
<td>8.3</td>
</tr>
<tr>
<td><strong>Gender (%)</strong></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>41.6</td>
</tr>
<tr>
<td>Female</td>
<td>58.4</td>
</tr>
<tr>
<td><strong>Age (years)</strong></td>
<td>69.2 (9.6)</td>
</tr>
<tr>
<td><strong>Education (years)</strong></td>
<td>12.5 (3.14)</td>
</tr>
<tr>
<td><strong>Household income ($ thousands)</strong></td>
<td>62.7 (162.6)</td>
</tr>
<tr>
<td><strong>Waist Circumference (inches)</strong></td>
<td>39.3 (6.0)</td>
</tr>
<tr>
<td><strong>Lifetime Discrimination (range: 0-6)</strong></td>
<td>0.5 (0.9)</td>
</tr>
<tr>
<td><strong>Everyday Discrimination (range: 0-5)</strong></td>
<td>0.6 (0.7)</td>
</tr>
</tbody>
</table>
Figure 1 - Age-adjusted Log-CRP Values by Race/Ethnicity and Gender

Mean Log-CRP Values (ug/mL)

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 2 - Average Years of Education by Race/Ethnicity

Table 2. Correlation Matrix for CRP and Continuous Predictor Variables

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study Variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>CRP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-0.03**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>-0.12***</td>
<td>-0.14***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Household Income</td>
<td>-0.09***</td>
<td>-0.17***</td>
<td>0.39***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI</td>
<td>0.31***</td>
<td>-0.21***</td>
<td>-0.06***</td>
<td>-0.03**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waist Circumference</td>
<td>0.28***</td>
<td>-0.06***</td>
<td>-0.07***</td>
<td>-0.03***</td>
<td>0.80***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depressive Symptoms</td>
<td>0.11***</td>
<td>-0.01***</td>
<td>-0.23***</td>
<td>-0.22***</td>
<td>0.11***</td>
<td>0.09***</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: *p ≤ 0.05; **p ≤ 0.01; ***p ≤ 0.001
Table 2 – Regression of Inflammation on Discrimination and Select Variables (n=11,935), Weighted

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Race/Ethnicity (ref. White)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>0.309***</td>
<td>0.231***</td>
<td>0.217***</td>
<td>0.195***</td>
<td>0.120**</td>
</tr>
<tr>
<td>Hispanic</td>
<td>0.140**</td>
<td>-0.072</td>
<td>-0.085</td>
<td>-0.034</td>
<td>-0.017</td>
</tr>
<tr>
<td>Gender (ref. Male)</td>
<td>0.213***</td>
<td>0.200***</td>
<td>0.186***</td>
<td>0.178***</td>
<td>0.338***</td>
</tr>
<tr>
<td>Education (years)</td>
<td>-0.053***</td>
<td>-0.048***</td>
<td>-0.034***</td>
<td>-0.023***</td>
<td></td>
</tr>
<tr>
<td>Household Income (log)</td>
<td>-0.019</td>
<td>-0.0004</td>
<td>0.002</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Smoking</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.293***</td>
</tr>
<tr>
<td>Waist Circumference (inches)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.041***</td>
</tr>
</tbody>
</table>

*p < 0.05, **p < 0.01, ***p < 0.001

Model 1: race/ethnicity, gender, marital status
Model 2: + education
Model 3: + household income, employment
Model 4: + behaviors
Model 5: + health factors
Conclusion

- Limitations
  - Subjectivity of SEM
  - Didn’t test behavioral pathways

- Strengths
  - Large, representative sample
  - Formal mediation analysis
  - Incorporates a measured biological marker

- Public Health Implications
  - Understanding of health disparities
  - Link social environment to biomarkers

Thank You

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