# The Association Between Social Factors and Inflammatory Levels Among US Adults

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## Introduction

The biological pathways through which social factors influence health are poorly understood. Social scientists have increasingly begun to collect blood markers to more fully characterize disparities in the health of populations and more accurately assess the risk of mortality at the older ages. One important set of markers that may help explain the association between **social factors** and late life **mortality** are related to **inflammatory processes**. We examine the relationship of SES, race, and immigration status with inflammatory levels among US adults.

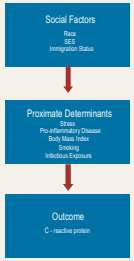
## Background

- **Inflammatory markers have been independently linked to cardiovascular disease** (Danesh et al., 2004, Pai et al., 2004). They may also be associated with other chronic conditions of the older ages including **diabetes** (Duncan et al., 2003) and **Alzheimer's Disease**.
- **Inflammatory markers have been associated with social factors, particularly SES** (Alley et al., 2005; Jousilahti et al., 2003).
- **Disparities in cardiovascular disease mortality across race and SES are persistent in the United States.** We hypothesize that inflammatory levels will also differ across population sub-groups.
- **Little is known about inflammatory levels among immigrant populations in the United States, particularly among Mexican immigrants.** Mexican immigrants tend to achieve a higher health status than their socioeconomic status would predict (Palloni & Arias, 2004). Therefore, they may show lower levels of chronic inflammation net of other factors. However, Mexican born individuals may have been exposed to a higher infectious burden over the life course, which may lead to higher chronic inflammatory levels. We compare inflammatory levels between Mexicans immigrants and the native US born population.
- **Quantile regression models have been shown to be useful in examining biological data** (Cade & Noon, 2003). We utilize them here to obtain a more thorough examination of how social factors are related to inflammatory processes.

## Research Questions

1) Do inflammatory levels differ across racial and SES groups? What is the nature of this relationship after controlling for other biological risk factors known to be associated with both social factors and old age mortality?
2) Do immigrants from Mexico carry a different inflammatory burden than the native US population?
3) How do quantile regression techniques aid in characterizing the relationship between social factors and inflammatory levels?

## Conceptual Model




## Data and Methods

- **National Health and Nutrition Examination Survey** (NHANES); 1999-2002
- Sample restricted to **adults** ages 20-84 years
- C-reactive protein was collected in **8,620** participants (N=8,620) ages 20-84
- **Ordinary Least Squares Regression** (OLS) and **quantile regressions** (least absolute value models) are used to analyze how social factors are related to C-reactive protein levels.

## Results

OLS regression of C-reactive protein (log-transformed) on social factors, medical conditions, and other circulating biological markers

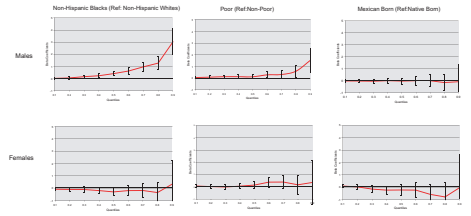
| | Males (Ages 20-84) | | | | Females (Ages 20-84) | | | |
|---|---|---|---|---|---|---|---|---|
| | I | II | III | IV | I | II | III | IV |
| Black, non-Hispanic[2] | **0.196** (0.038)*** | **0.173** (0.054)** | **0.165** (0.053)** | **0.216** (0.054)*** | **0.295** (0.076)*** | 0.004 (0.071) | -0.001 (0.071) | -0.041 (0.076) |
| Poor (PIR<=1)[3] | **0.247** (0.085)** | 0.168 (0.088) | 0.131 (0.088) | 0.123 (0.092) | 0.116 (0.090) | 0.047 (0.076) | 0.041 (0.076) | -0.002 (0.075) |
| Mexican Born[2] | **-0.315** (0.095)** | -0.158 (0.083) | -0.14 (0.082) | -0.147 (0.088) | -0.139 (0.105) | -0.001 (0.087) | -0.044 (0.087) | -0.035 (0.090) |
| Observations | 3946 | 3823 | 3819 | 3759 | 3888 | 3778 | 3773 | 3606 |
| R-Squared | 0.07 | 0.19 | 0.19 | 0.21 | 0.05 | 0.26 | 0.26 | 0.27 |

* significant at 5% level; ** significant at 1% level
[1] Reference category is Non-Hispanic White
[2] Reference Native U.S. Born
[3] Reference Non-Poor (PIR>1)

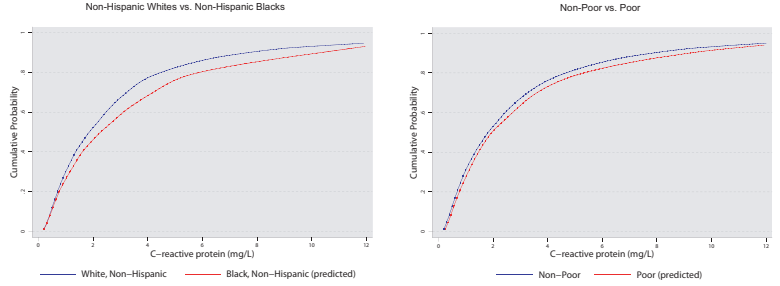
Model I: Adjusted for age, reported infection in prior 30 days
Model II: Model I + smoking, body mass index
Model III: Model II + past reported history of cardiovascular disease, diabetes, cancer, arthritis, emphysema, chronic bronchitis, and asthma
Model IV: Model III + systolic blood pressure, glycohemoglobin, HDL cholesterol, total cholesterol

Quantile Regressions

*Note: Adjusted for age, self-reported infection in prior 30 days, smoking, body mass index, self-reported history of chronic conditions, and other circulating biomarkers.*




Cumulative Distribution Function - Predicted from Quantile Regressions




## Discussion & Summary

- **Our research suggests that in males both Blacks and the poor have significantly higher inflammatory levels than Whites and the non-poor.** We did not find this relationship in females.
- **We did not find a difference between inflammatory levels in Mexican immigrants as compared with the native born population.** This is consistent with other health related studies, which show better health outcomes for this population.
- **Quantile regression models highlight the different associations of social factors with inflammation for men in the upper tail of their distribution.** Disadvantaged men who have the highest levels of inflammation and possibly other forms of physiologic dysregulation may have less access to health care resources and social support mechanisms as compared with other men.
- **Possible reasons for different associations across sex:**

  (1) *Institutional* – Disadvantaged women may be able to take advantage of health services (maternal/child) as compared w/ disadvantaged men.

  (2) *Social* – Women may have better coping mechanisms and social networks to deal with adverse conditions (e.g. poverty, racism).

## Limitations

- Causality is difficult to infer because of cross-sectional nature of study.
- Measures of medical conditions are self-reported rather than clinically diagnosed.
- No information about medication usage was included in the model.

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Penn Demography