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# The association between acculturation & C-reactive protein in U.S. immigrants: a cross-sectional study

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## Introduction

- Immigrants and their U.S.-born children make up 27% of the U.S. population.<sup>1</sup>
- Acculturation is the process of cultural and psychological changes as an individual assimilates to a different or dominant culture.<sup>2</sup>
- Acculturation can be a source of immense stress.<sup>3</sup>
- C-reactive protein (CRP) is a marker for inflammation made by the liver.<sup>4</sup>
- Intense stressors can over-activate the immune system and cause disease.<sup>3</sup>
- The number of years living in the United States may be a protective factor against acculturative stress.<sup>5</sup>
- Exposure to stressors of racism and the acculturation process may differ by race and ethnicity.<sup>2,6,7</sup>
- The extent of acculturation's impact on CRP is not well known.

## Objective & Hypotheses

**Objective:** To examine the association between acculturation and C-reactive protein (CRP) among U.S. adult immigrants.

**Hypotheses:** Foreign-born adults 20 years and older in the United States with higher degrees of acculturation will have higher CRP levels compared to those with lower degrees of acculturation. The association between acculturation and CRP will differ by years living in the United States and race/ethnicity.

## Methods

**Participants:** Foreign-born participants in the NHANES 2017-2018 cycle, aged 20 years and older with complete data on acculturation and C-reactive protein (n = 1526). Due to the acculturation response choices varying by race/ethnicity, we conducted separate analyses on a subgroup of Hispanic and non-Hispanic Asian participants (n = 1259).

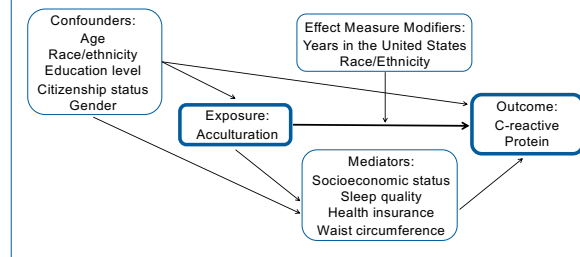
**Study Design:** This is a cross-sectional study. NHANES uses a complex sample design involving stratified, clustered four-stage samples.<sup>8</sup>

**Exposure measure:** We assessed acculturation with a proxy measure of language usually spoken in the home, collected by direct interview.<sup>9</sup> We dichotomized the variable for the overall sample and created three levels for the subgroup.

**Outcome measure:** High-sensitivity C-reactive protein (CRP) was measured from blood samples.<sup>10</sup> We examined the full range of the log-transformed variable continuously.

**Analyses:** We conducted multivariable regression analyses with survey weights and reported the percent difference in CRP with 95% confidence intervals. We used a theoretical approach to assess potential confounding variables. We assessed for effect measure modification (EMM) of years living in the United States in the overall sample with an interaction variable of the product of Acculturation and Years Living in the United States. We assessed for EMM of race/ethnicity by stratification in the subgroup of Hispanic and non-Hispanic Asian participants.

## Causal Framework



## Results

### Association between acculturation & C-reactive protein in foreign-born NHANES 2017-2018 participants aged 20 years and older (n = 1526)

	C-reactive protein (mg/L)		
	Mean (SE)	Model 1: Crude	Model 2: Adjusted <sup>a</sup>
		Percent Difference (95% CI)	Percent Difference (95% CI)
<b>Level of acculturation</b>			
Lower acculturation (ref.)	0.56 (0.03)	--	--
Higher acculturation	0.56 (0.07)	-0.6 (-12.5, 12.9)	5.3 (-7.3, 19.6)
<b>Interaction</b>			
Acculturation*Years in U.S.	--	--	8.5 (-14.3, 34.8)

SE, Standard error; CI, Confidence interval; ref., Reference group  
<sup>a</sup>Adjusted for age, race/ethnicity, education, U.S. citizenship status, and gender

### Association between acculturation & C-reactive protein in a subgroup of Hispanic and non-Hispanic Asian foreign-born NHANES 2017-2018 participants aged 20 years and older (n = 1259)

	C-reactive protein (mg/L)	
	Model 1: Crude	Model 2: Adjusted <sup>a</sup>
	Percent Difference (95% CI)	Percent Difference (95% CI)
<b>Race/ethnicity</b>		
Hispanic	Low acculturation (ref.)	--
	Moderate acculturation	-17.7 (-29.6, -3.8)
	High acculturation	9.4 (-30.3, 71.7)
Non-Hispanic Asian	Low acculturation (ref.)	--
	Moderate acculturation	-0.05 (-21.1, 26.6)
	High acculturation	-9.5 (-30.5, 18.0)

SE, Standard error; CI, Confidence interval; ref., Reference group  
<sup>a</sup>Adjusted for age, education, U.S. citizenship status, and gender

## Key Results

*Our findings do not support our hypothesis that higher degrees of acculturation are associated with higher levels of C-reactive protein (CRP).*

**Main analysis:** Higher acculturation was not significantly associated with higher CRP levels after adjusting for age, race/ethnicity, education level, citizenship status, and gender. There was no evidence of effect measure modification by years living in the United States.

**Subgroup analysis:** Race/ethnicity modifies the association between acculturation and c-reactive protein. Among the Hispanic participants, moderate acculturation was associated with lower CRP levels compared to those with low acculturation after adjusting for age, education level, citizenship status, and gender.

## Discussion

- Strengths of our study include a nationally representative sample and an outcome measure collected under standardized lab procedures.
- Results of our main analysis are generalizable to foreign-born U.S. residents who are aged 20 years and older.
- Results of our subgroup analysis are generalizable to foreign-born Hispanic and non-Hispanic Asian U.S. residents who are aged 20 years and older.
- Our findings differ from prior research studies, which measured acculturation directly through validated questionnaires.<sup>11</sup>
- Our study used an established single-item proxy measure of acculturation which only captured a small portion of the acculturation process.
- Exposure and outcome data were collected at the same time, so we cannot assess the temporality of the relationship between acculturation and CRP.
- We have several theorized mediators that could have been confounders depending on timing.
- Our results indicate that the acculturation process is complex and may vary between different cultural and ethnic groups.
- Future studies should consider measures of acculturative stress and stratify by racial or ethnic groups.

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