



ORIGINAL RESEARCH ARTICLE

Climbing the ladder of decline: Income and acculturation associated with chronic inflammation among Mexican immigrants

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Abstract

Objectives: Financial hardship and immigrant status are often associated with poorer health as immigrant groups acculturate to life in the US. Known as the Latino health paradox, studies have shown that Latino/a immigrants in particular often experience declines in health the more they embrace ways of life considered “dominant” by US society. At present, critical biological pathways linking socioeconomic and acculturative processes remain to be better explained. The present study investigates associations among financial strain, acculturation, and chronic inflammation.

Methods: In our study of 129 Mexican-born immigrants living in the US, we used Pearson's correlations and multiple regression analyses to investigate links among income-to-poverty ratio (an indicator of financial strain), English language engagement (acculturation), and C-reactive protein (CRP), a measure of systemic inflammation.

Results: Results showed that for men, but not women, acculturation as defined by English language engagement moderated the association between an income-to-poverty ratio and CRP levels.

Conclusions: Consistent with the Latino health paradox, more acculturated men with relatively higher income levels (compared with the study sample) had significantly higher levels of CRP.

1 | INTRODUCTION

The experience of financial strain has been shown to increase the risk of poor health outcomes among adults (Prentice, McKillop, & French, 2017; Szanton, Thorpe, & Whitfield, 2010). Cardio-metabolic risk factors such as visceral obesity (Caspi et al., 2017), hypertension (Richardson et al., 2012), insulin resistance (Agardh, Allebeck, Hallqvist, Moradi, & Sidorchuk, 2011), and dyslipidemia (Rodriguez et al., 2014), all have higher prevalence rates among adults with limited financial means. The presence of such factors, in turn, is associated with increased risk of cardiovascular disease, certain

cancers, and multiple other causes of early mortality. Although financial strain has been linked with both risk and disease, the mechanisms underlying these associations and how they operate in at-risk populations remain to be better explicated (Alberti, Zimmet, & Shaw, 2005).

Financial strain, which is conceptualized as the inadequacy of one's income to cover the costs of living (Szanton et al., 2010), is thought to influence physical health through several primary mechanisms. One mechanism involves the direct effect of limited resources on health. Financial resources are critical to health because they provide access to basic necessities, including food, medical care, and shelter



(Link & Phelan, 1996; Sturgeon, Zautra, & Okun, 2014). When one's income limits access to vital resources, both subjective and objective measures of health and well-being may be compromised (Oakes & Rossi, 2003; Richardson et al., 2012).

Financial strain is also linked to poor health via alterations in biological functioning, in particular, via disruptions to the regulation of inflammatory processes vital to health (McEwen, 1998; Seeman et al., 2004). Inflammation is a crucial aspect of the body's response to illness. When faced with infection or injury, an inflammatory response is initiated by pro-inflammatory cytokines (Hänsel, Hong, Camara, & Von Kaenel, 2010). These pro-inflammatory cytokines are critical signaling molecules involved in the onset and maintenance of inflammation, causing white blood cells and T-cells to gather at the sight of damage to fight pathogens and repair tissue (Owen & Punt, 2002). In response to the release of pro-inflammatory cytokines, acute phase proteins such as C-reactive protein (CRP) are synthesized and released by the liver to further the repair and removal of damaged cells (Hänsel et al., 2010; Pepys & Hirschfield, 2003). Although increases in CRP are a necessary response to acute challenge, chronic activation of the immune system results in the harmful accumulation of CRP (Johnson, Riley, Granger, & Riis, 2013). High circulating levels of CRP have been linked to type 2 diabetes and different forms of cardiovascular disease (Dehnavi et al., 2008; Michaud et al., 2013; Miller & Chen, 2007; Miller, Haroon, Raison, & Felger, 2013). Although models proposing links between financial strain and inflammation have received some attention, few studies have investigated the generalizability of possible causal processes in diverse populations (see Friedman & Herd, 2010). Given that socioeconomic and health resources are unequally distributed in the population, a particularly important target of investigation would be low-income ethnic or racial minorities and immigrant groups for whom financial strain may be more prevalent and unrelenting (Wilson, Thorpe Jr, & LaVeist, 2017).

1.1 | Financial strain and immigrant health: A paradox

Limited access to employment that is consistent and involves a living wage is an especially typical experience among first generation immigrant communities in the United States (Shor, Roelfs, & Vang, 2017). Immigrants' earning potential can be limited by language barriers, nontransferable job skills, and discriminatory hiring practices (Villarreal & Tamborini, 2018). Moreover, combined with the effects of recent and lingering global economic downturns, the health effects of financial adversity could be particularly pronounced among immigrants.

Interestingly, studies suggest that immigrants, in particular Latin American origin immigrants, are often healthier than their compatriots who remain in their countries of origin and healthier than native-born residents living in the US (Lutsey et al., 2008; Shor et al., 2017). Often referred to as the "Latino (or Hispanic) immigrant health paradox" (Feliciano & Lanuza, 2017; Markides & Coreil, 1986; Motti-Stefanidi & Coll, 2018), numerous studies have reported better health among Mexican immigrants relative to Mexican-American and US-born Whites. Such advantages have been observed relative to cardiovascular outcomes (Singh & Siahpush, 2001) as well as premature mortality (Palloni & Arias, 2004). Differences of this sort have been attributed to selectivity effects, namely the optimism, high work-ethic, and the aspirations for financial betterment that often characterize migrating individuals (Martinez, Aguayo-Tellez, & Rangel-Gonzalez, 2015). Other protective factors have been proposed to explain this paradox, including residing in supportive co-ethnic enclaves (Viruell-Fuentes, 2007), and health-promoting behaviors rooted in cultures of origin (Dixon, Sundquist, & Winkleby, 2000; Guendelman & Abrams, 1995). However, studies of acculturation reveal that the longer Latino immigrants reside in the US, the more their health status deteriorates even if their financial conditions improve (Feliciano & Lanuza, 2017; Motti-Stefanidi & Coll, 2018). Worsening health among Mexican origin individuals in the US has been attributed to the adoption of unhealthy American lifestyles (eg, poor diet; Abrams & Guendelman, 1995). Our own group has reported that among foreign-born Mexican farm workers, increased contact with the dominant culture correlates with more exposure to discrimination and, in turn, more stress-linked health problems, including compromised cardiovascular, metabolic, and immune functioning (McClure et al., 2010, 2015; Squires et al., 2012).

In this study, we investigated the links between financial strain and immune function in a sample of Mexican-born immigrants living in the US Northwest at varying stages of acculturation. Our first objective was to investigate linkages between Mexican immigrant adults' financial strain and individual differences in their CRP levels. Given documented differences both in males and females immigrants' income levels (Blau, 2016; Dion & Dion, 2001) and CRP levels (Lakoski et al., 2006), our primary analyses considered males and females separately. In general, we hypothesized that higher levels of CRP would be related to greater financial strain. Given strong evidence of a Latino immigrant paradox, this initial hypothesis was tempered such that we thought it also likely that the association between higher financial strain and elevated CRP might be moderated by participants' levels of acculturation. Accordingly, our second objective was to test whether residential locale also might moderate possible associations between financial strain and

CRP levels when added to a model including participants' levels of acculturation. The participants in our sample lived either in a predominantly Mexican community or in majority White communities.

2 | MATERIALS AND METHODS

2.1 | Participants

The data for this project were collected in collaboration with an Oregon-based farmworker housing organization. A sample of 126 adults, ages 18 to 73, was recruited with the assistance of the farmworker housing organization. Participants in this study resided in either one of two predominantly White communities or a town that was an established Mexican origin enclave. The Institutional Review Board at the Oregon Social Learning Center approved the research protocol and all participants provided written consent prior to the assessment. All respondents were assessed in Spanish. Approximately 42% of men and 34% of women had a third grade education or less, with 7% of men and

18% of women completing high school or receiving post-secondary education. Heads of household reported an annual median household income of \$16 218 to support an average household of five people ($SD = 1.5$); 93% of men and 47% of women were employed, 37% of women reported being home-makers. On average, participants had resided in the US for 11 years ($SD = 8.28$ years). These and additional demographics are presented in Table 1.

2.2 | Measures

2.2.1 | Financial strain/income-to-poverty ratio

Self-reported demographic, income, and health information was collected via standardized interview and survey procedures used extensively in our prior research (McClure et al., 2010, 2015; Squires et al., 2012). Based on household size and reported household income, contemporaneous US census poverty estimates were used to compute the income-to-poverty ratio (IPR). Following Okosun, Annor,

TABLE 1 Participant demographic information and descriptive statistics

Variables	Total (<i>N</i> = 129) M(SD) or %	Women (<i>n</i> = 83) M(SD) or %	Men (<i>n</i> = 46) M(SD) or %	Test statistic	
				<i>F</i> / <i>X</i> ²	<i>P</i>
<i>Sociodemographic</i>					
Age (years)	36.8 (12.0)	35.8 (11.40)	38.70 (12.96)	1.64	.20
Marital status (% married)	76.7	87.0	71.1	4.18	.04
Education	2.50 (1.61)	2.56 (1.68)	2.38 (1.48)	.38	.54
Employment				33.36	<.001
% Unemployed	12.5	14.6	8.7		
% Home maker	28.1	43.9	0.0		
% Employed	59.4	41.5	91.3		
Household income (\$)	18 598 (9028)	18 133 (9368)	19 210 (8627)	1.54	.22
Household size	4.96 (1.52)	4.89 (1.55)	5.09 (1.47)	.48	.49
IPR	.73 (.36)	.74 (.37)	.72 (.34)	.02	.90
<i>Acculturation</i>					
Arrival age (years)	24.6 (10.6)	25.33 (11.21)	23.2 (9.5)	1.16	.28
Time in residence (years)	11.34 (8.28)	9.83 (3.78)	14.07 (9.70)	8.18	.01
SITE				.03	.86
% Majority White	59.9	59.3	60.0		
% Majority Mexican	40.1	40.7	40.1		
ELO	2.86 (1.24)	2.25 (1.34)	2.27 (1.24)	.02	.89
<i>Health</i>					
Smoker					
BMI	29.11 (5.54)	29.76 (6.09)	27.96 (4.22)	3.19	.08
CRP (mg/L)	1.52 (1.67)	1.74 (1.79)	1.14 (1.37)	2.32	.13

Abbreviations: BMI, body mass index; CRP, C-reactive protein; ELO, English language orientation; IPR, Income-to-poverty ratio; SITE, site of residence.



Seale, and Eriksen (2014), we conceptualized IPR as our measure of financial strain given evidence that such ratios are more robust estimates of financial standing than are measures of household income alone. Specifically, total household income was divided by the corresponding federal poverty level for a given household size, such that resulting values less than 1 indicate an IPR that was below the poverty line, with values greater than 1 indicating an IPR greater than the poverty line. Prior to computing this ratio, household incomes were adjusted (ie, our final values reflect annual income minus annual remittances) in instances where participants reported sending financial remittances back to families in their country of origin. On average, families reported sending an average of \$970 per year (SD = \$1618) in remittances.

2.2.2 | C-reactive protein

CRP was analyzed through high-sensitivity enzyme immunoassay using validated protocols adapted for dried blood spots. Four individuals with current infections (serum equivalent CRP concentrations of 5 mg/L or higher) were excluded due to acute effects of infection on inflammation (Miller & Chen, 2007). Given the skewed nature of the data, all CRP values were log-10 transformed and log10CRP was used in all subsequent analyses, although in Table 1 we present untransformed CRP values (mg/L) for ease of reference.

2.2.3 | Additional health measures

To account for the possibility of other health factors accounting for variation in CRP, we also computed participants' body mass index (BMI; derived through direct measurement of weight and height) as well as self-reported levels of current smoking (1 = every day to 3 = do not smoke).

2.2.4 | Measures of acculturation

Participants reported several factors, which together comprised our set of acculturation measures. Specifically, participants reported their age at arrival in the US as well as years of US residence.

Additionally, participants reported their English language orientation (ELO), which reflected comfort speaking and reading in English (1 = very uncomfortable to 5 = very comfortable) and enjoyment of English language activities (eg, music, TV or radio programs; 1 = do not enjoy to 5 = enjoy very much). Scores on these three measures were composited into a single score using a principal components analysis (PCA), with higher ELO scores reflecting greater orientation to the English language. The Kaiser-Meyer-Olkin

(KMO) test of sampling adequacy was .637 (considered acceptable); this factor explained 61% of observed variance.

Additionally, we recorded participants' site of residence (SITE). Specifically, all participants resided in either White dominant locales or within an established and historic Mexican origin community. Our SITE variable was thus a dichotomous measure of the cultural composition of one's residence (1 = predominantly White or 2 = predominantly Mexican).

3 | RESULTS

3.1 | Preliminary analyses

Demographic and descriptive data for all study variables are reported in Table 1, which we have presented for the entire sample and disaggregated by participant sex. We tested differences between men and women on these variables; corresponding test statistics are presented in Table 1. Significant differences between men and women were recorded on measures of marital status, employment, and years of US residence; BMI approached significance. Specifically, more women were married at the time of study, women had resided in the US for less time than men, women were more likely to be unemployed or homemakers compared to men, and women had moderately higher BMIs than men.

Although household income levels were not significantly different between women and men, the sample was noteworthy for the level of financial strain. Specifically, the IPR, adjusted for remittances, indicated that the sample as a whole was below the current federal poverty level, with average household incomes of ~\$18 000 for an average family of five.

The average CRP level of 1.52 (mg/L) was indicative of low levels of chronic inflammation. However, considerable variability in CRP indicated that some individuals had clinically significant levels. Specifically, 18.4% of the sample had CRP levels that exceeded 3 mg/L, which has been associated with risks for cardiovascular disease and various cancers (Lu, Ouyang, & Huang, 2006).

Prior to conducting our central analyses, we correlated our demographics, acculturation, and health variables with CRP (log10 transformation) to identify potential covariates. As shown in Table 2, both participants' age and age at arrival were significantly correlated with CRP, with older individuals and individuals residing in the US longer having higher CRP levels. IPR was also associated with CRP, but only for men. Contrary to expectation, higher IPR scores—or earnings that exceeded the poverty line—were associated with higher levels of CRP for men. Higher BMI was also significantly associated with higher CRP for both men and women. Finally, neither SITE nor ELO was associated significantly with CRP, although women who resided in predominantly

TABLE 2 Sociodemographic, acculturation, and health correlates of log 10 CRP

Variables	Total sample log 10 CRP	Men's log 10 CRP	Women's log 10 CRP
<i>Sociodemographic</i>			
Age (years)	0.28**	0.44**	0.35**
Marital Status	0.06	−0.06	0.13
Education	−.07	−0.13	−0.07
Employment	−.015	−0.21	−0.09
IPR	0.19#	0.49**	−0.08
<i>Acculturation</i>			
Arrival age (years)	0.25**	0.39**	0.14
Time in residence (years)	0.05	−0.03	0.13
SITE	0.17	0.09	0.21#
ELO	−0.08	−0.10	−0.05
<i>Health</i>			
BMI	0.46***	0.40**	0.56***
Smoker	0.05	0.02	0.07

Note: # $P < .10$; * $P < .05$; ** $P = .01$; *** $P < .001$.

Mexican communities had levels of CRP that were moderately higher than women living in predominantly White communities.

Based on these initial results, in our central analyses we controlled for BMI and participants' chronological age. Although current age and age at time of arrival in the US were significantly correlated ($r = .56$, $P < .000$), we elected to covary current age only in light of its known associations with CRP and to avoid the issue of multi-collinearity given the size of our sample. We should also note that despite the correlation between chronological age and age on arrival, age of arrival was not a significant predictor in any of the regression models (reported below) which further justified our choice to use chronological age. Additionally, given several clear differences between men and women, most notably in their employment status, we elected to analyze men and women separately.

3.2 | Central analyses

We conducted a series of separate multiple regression analyses for men and women to examine the extent to which financial strain was associated with individual differences in CRP levels (Model 1). Secondly, we tested whether this association was moderated by participants' level of

acculturation (Model 2). A pair of such models were tested both for our measure of ELO and for SITE.

3.2.1 | English language orientation

Testing men and women separately, in the first pair of regression models, participant age and BMI were entered as covariates along with our main predictors, IPR and ELO (Model 1). As shown in the top panel of Table 3, men's older age and greater BMI were significantly associated with higher log 10 CRP. Contrary to expectation, higher IPR was associated with significantly higher log 10 CRP than was lower IPR. Men's ELO was not associated with CRP. Model 2 then tested the mean-centered interaction between IPR and ELO. As shown in Table 3, this interaction was significant for men and nearly accounted for the main effect of IPR. As shown in the lower panel of Table 3, only BMI was significantly related to higher log 10 CRP among women.

We next probed the significant interaction for men using the Johnson-Neyman technique (Bauer & Curran, 2005), which identifies the ranges of the moderator (ie, ELO) in which the focal predictor (ie, IPR) correlates with CRP. To aid with interpretation, we dichotomized ELO using a median split, which resulted in a group of high vs low ELO participants. As shown in Figure 1A, men with high ELO who earned more income had significantly higher levels of CRP than did high ELO men earning lower levels of income. In contrast, low ELO men had comparable levels of CRP across the entire income range. Our region of significance analysis revealed that there was both a lower and upper region of significance. Specifically, at the upper boundary, compared to low ELO men, high ELO men at an IPR of 1.16% or 116% of poverty had significantly higher CRP. In contrast, in the lower boundary, high ELO men had significantly lower CRP levels than low ELO men at an IPR of .18% or 18% of poverty. Although the interaction between ELO and IPR was not significant for women, a probe of their interaction is presented in Figure 1B for comparison purposes.

3.2.2 | SITE

In a final set of regression models, we examined whether the demographic composition of their residential locale predicted log 10 CRP. As shown in the top panel of Table 4, men's older age, greater BMI, and higher IPR were associated with significantly higher log 10 CRP. Unlike ELO, men's SITE was not associated with CRP; in Model 2, the mean-centered interaction between IPR and SITE was not significant. As shown in the lower panel of Table 4, only women's BMI was significantly predictive of higher log 10 CRP.

TABLE 3 Income-to-poverty ratio, English language orientation, and log 10 C-reactive protein

Log10 CRP						
Model 1				Model 2		
	<i>B</i> (SE)	<i>t</i>	(95% CI)	<i>B</i> (SE)	<i>t</i>	(95% CI)
Males						
Age	.01 (.00)	3.15**	(.00, .02)	.01(.00)	3.56***	(.00, .02)
BMI	.05 (.01)	4.05***	(.00, .05)	.05 (.01)	4.00***	(.02, .07)
IPR	.36 (.14)	2.65**	(.08, .63)	.14 (.10)	1.67#	(−.02, .38)
ELO	.03 (.07)	0.45	(−.10, .17)	.05 (.06)	0.79	(−.08, .18)
IPR by ELO				.36 (.17)	2.12***	(.02, .71)
<i>F</i> (4,42) = 10.63, <i>p</i> < .001, <i>Adj R</i> ² = .49				<i>F</i> (5,41) = 10.25, <i>p</i> < .000, <i>Adj R</i> ² = .54		
Females						
Age	.0 (.01)	0.25	(−.01, .13)	.00 (.01)	0.25	(−.01, .01)
BMI	.05 (.01)	3.77***	(.02, .07)	.04 (.01)	3.77***	(.02, .07)
IPR	.07 (.16)	0.42	(−.26, .40)	.07 (.17)	0.42	(−.26, .40)
ELO	.02 (.06)	0.26	(−.11, .14)	.02 (.06)	0.26	(−.11, .14)
IPR by ELO				.01 (.18)	0.06	(−.34, .36)
<i>F</i> (4,75) = 3.92, <i>P</i> = .003, <i>Adj R</i> ² = .20				<i>F</i> (5,74) = 3.07, <i>P</i> = .007, <i>Adj R</i> ² = .20		

Abbreviations: BMI, body mass index; CRP, C-reactive protein; ELO, English language orientation; IPR, income-to-poverty ratio; IPR by ELO, interaction of income-to-poverty by English language orientation.

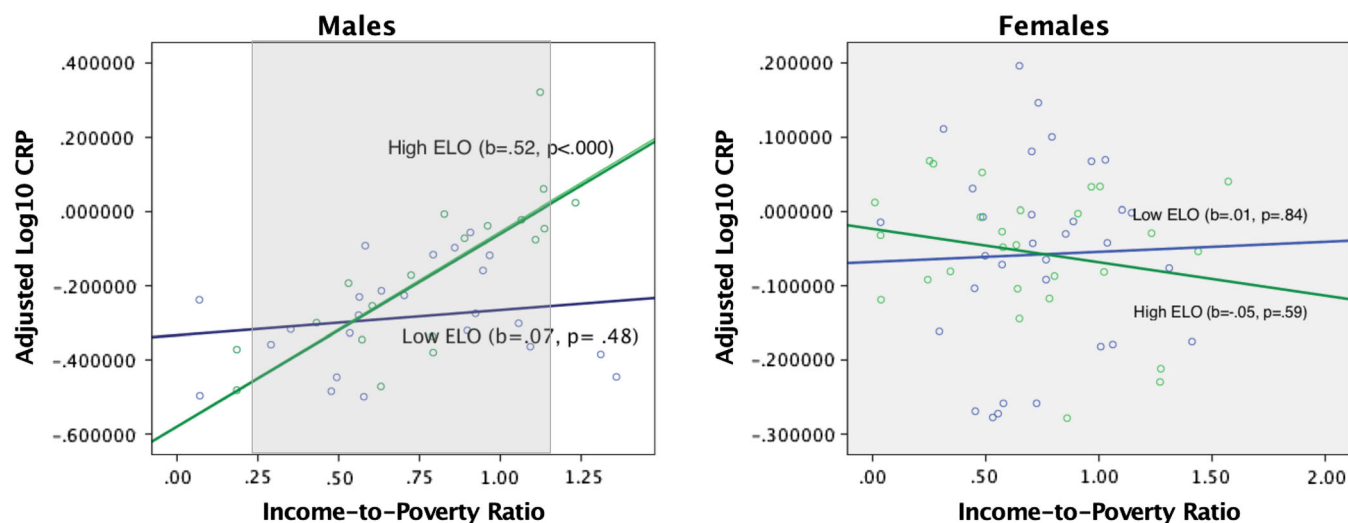


FIGURE 1 Analysis of covariance of income-to-poverty ratio, C-reactive protein and English language orientation (adjusted for age and body mass index) for male Latino immigrants. Analysis of covariance of income-to-poverty ratio, C-reactive protein and English language orientation (adjusted for age and body mass index) for female Latina immigrants

4 | DISCUSSION

In this study, we investigated the links between financial strain, as measured by an IPR, and chronic, low-grade inflammation in a sample of Mexican immigrants living in the US Northwest. Because all participants were born in Mexico prior to their

immigration to the US, we were also interested in testing whether acculturation might moderate the association between financial strain and levels of CRP. Although our sample of men and women reported household incomes that were typically hovering around the US poverty line, our results indicate that Mexican men reporting higher incomes had higher levels of

TABLE 4 Income-to-poverty ratio, site of residence, and log 10 C-reactive protein

	Log10 CRP					
	Model 1			Model 2		
	B (SE)	<i>t</i>	(95% CI)	<i>B</i> (SE)	<i>t</i>	(95% CI)
Males						
Age	.01 (.00)	2.95**	(.00, .02)	.01(.00)	2.95**	(.00, .02)
BMI	.05 (.01)	4.00***	(.02, .07)	.05 (.01)	3.82***	(.02, .07)
IPR	.35 (.14)	2.50*	(.07, .63)	.63 (.42)	1.49	(−.23, .89)
SITE	.04 (.10)	0.34	(−18, .25)	.04 (.10)	0.37	(−.17, .25)
IPR by SITE				−.20 (.20)	−0.70	(−.77, .36)
	<i>F</i> (4,42) = 10.58, <i>P</i> < .001, <i>Adj R</i> ² = .50			<i>F</i> (5,41) = 9.43, <i>P</i> < .000, <i>Adj R</i> ² = .49		
Females						
Age	.00 (.01)	0.19	(−.01, .11)	.00 (.01)	0.17	(−.01, .01)
BMI	.04 (.01)	3.41***	(.02, .07)	.04 (.01)	3.36**	(.02, .07)
IPR	.08 (.16)	0.51	(−.24, .40)	−.03 (.48)	−0.52	(−.99, .94)
SITE	.13 (.14)	0.97	(−.15, .41)	.13 (.14)	0.95	(−.15, .42)
IPR by SITE				.08 (.34)	0.23	(−.61, .76)
	<i>F</i> (4,75) = 4.20, <i>P</i> = .006, <i>Adj R</i> ² = .21			<i>F</i> (5,74) = 3.30, <i>P</i> = .013 <i>Adj R</i> ² = .19		

Abbreviations: BMI, body mass index; CRP, C-reactive protein; IPR, income-to-poverty ratio; IPR by SITE, interaction of income-to-poverty by site of residence; SITE, site of residence.

inflammation; there was no association for women. This effect, however, was conditioned by men's level of acculturation. Specifically, we found that among the most acculturated men, by virtue of higher comfort with and use of English, more income was associated with the highest levels of inflammation whereas lower income was associated with less inflammation. Women's English language engagement did not moderate the association between financial strain and inflammation.

These results add to growing evidence that experiences of acculturation following immigration to the US can compromise immunologic health, at least among men, despite modestly greater financial resources (Kaestner, Pearson, Keene, & Geronimus, 2009; McClure et al., 2015). Given ample evidence showing that lower rather than higher income is associated with increased risk of poor health outcomes (Prentice et al., 2017; Szanton et al., 2010), we were surprised that men earning somewhat higher incomes relative to the poverty line had higher CRP levels. However, these higher income levels relative to the US poverty line were minimal at best (typically no more than \$3,000-\$5,000 annually given household sizes and corresponding poverty rates), and likely did little to increase health enhancing resources and, in particular, improve access to health care. Instead, our results suggest that this higher income may have come at a cost for men who engage in more English language activities. Such an interpretation would seem consistent with prior evidence that among Mexican immigrants,

increased acculturation might bring these individuals into contact with certain health compromising aspects of US society. Greater English language engagement could mean more contact with discrimination—the ability to comprehend when an English speaker is using pejorative language—which has clear links with decreased health (McClure et al., 2015; Squires et al., 2012). Alternatively, increased acculturation may usher in certain health compromising behaviors that can be associated with improved finances, such as decreased physical activity (Leonard et al., 2013; Rivas-Marino et al., 2015).

Our income and acculturation findings were limited to Mexican men and not women, although women's higher BMI was also associated with elevated CRP. The men and women in our sample reported similar household incomes, time in country, and were comparable on both measures of acculturation. Nevertheless, neither income nor acculturation were associated with Mexican immigrant women's inflammation. This may have been due to the fact that nearly half of all women in the present study reported being homemakers rather than working outside of the home like virtually all of the men in the sample. Although social isolation has known links to compromised health (Cacioppo John & Patrick, 2008), some women's stay-at-home status may have provided forms of protection against some of the health-compromising effects of greater contact with dominant US culture.



Unlike comfort with the English language, participants' site of residence was not predictive of inflammation, nor did site of residence moderate income as anticipated. Two possible explanations seem likely in this case. First, though nearly 60% of the sample lived in majority White communities vs Mexican dominant farming communities, a larger majority of working men and women in this sample worked as agricultural field workers with fellow Mexican immigrants. We suspect that daily contact with fellow immigrants may have minimized some of the confusing or stressful social interactions or unfair treatment that is often experienced by immigrants as they assimilate into US dominant working and living communities (Williams & Collins, 2001). Second, and alternatively, it is also possible that our sample may have experienced comparable levels of discrimination in either locale, whether significant or benign amounts. Just as studies have shown that inter-group discrimination has health consequences, with-in group discrimination does as well, such as has been documented based on region of nativity (Córdova Jr & Cervantes, 2010) and skin-color (Chavez-Dueñas, Adames, & Organista, 2014).

This study's findings must be considered in light of several important limitations. First, while there was adequate variability in our measure of CRP, most participants had levels that would be considered sub-clinical; this tempers our ability to speak to the more serious health effects of financial strain or acculturation. Due to the reliance on a nonprobability design, our results may also be less relevant to Mexican immigrants who live in other regions of Oregon or the US. A more random, representative sample of Mexican immigrants may have produced different results. Third, we relied on participant report of English language comfort and proficiency rather than a more objective measure of proficiency. Although the men in this sample may have reported higher English language orientation, which we associated with increased acculturation, it is possible that these self-reports may not have been as accurate as we might have wished and that these men may have experienced unfair treatment related to others perceiving of them as emerging English speakers (Bleakley & Chin, 2004; Kominski, 1989). Finally, our small sample size required precluding several other important analyses, such as the examination of health differences associated with employment type. Although the majority were employed in farm work, we were unable to account for possible differences in status level or determine whether some of our sample had achieved managerial levels, which often confer increased stress.

Nevertheless, our primary finding that acculturation was associated with increased inflammation among immigrant men adds evidence to the assertion that aspects of the US experience can compromise health, even when one makes financial gains. For the Mexican men in our sample, modest

advantages in income relative to lower earning compatriots was associated with higher inflammation even as they reported greater comfort with English. Although these results have cultural and psychosocial implications, the biological ramifications would seem the most concerning given that the regulation of inflammatory processes is so vital to health.

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AUTHOR CONTRIBUTIONS

E.A.M. conducted analyses and led the writing of the present manuscript. H.H.M. collaborated closely with E.A.M. on the initial conceptualization and writing of this article and all authors provided reviews of the manuscript. As project PI, H.H.M. conceived of the project in consultation with C.M. and J.S. H.H.M., J.S., L.I., and R.J. collaborated on study design and data collection. L.I. led recruitment and retention of participants. C.M. provided mentorship related to data analyses. J.S. was responsible for all protocols related to the collection of blood spots, training of assessors in the collection of biological data, and the analyses of C-reactive protein.

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