



## Diurnal salivary cortisol and nativity/duration of residence in Latinos: The Multi-Ethnic Study of Atherosclerosis



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### ABSTRACT

Latino immigrants have lower prevalence of depression, obesity and cardiovascular disease than US-born Latinos when they are recently arrived in the US, but this health advantage erodes with increasing duration of US residence. Cumulative exposure to psychosocial stress and its physiological sequelae may mediate the relationship between nativity and duration of US residence and poor health. We used data from Latino cohort study participants ages 45–84 to examine cross-sectional ( $n = 558$ ) and longitudinal ( $n = 248$ ) associations between nativity and duration of US residence and features of the diurnal cortisol curve including: wake-up cortisol, cortisol awakening response (CAR, wake-up to 30 min post-awakening), early decline (30 min to 2 h post-awakening) and late decline (2 h post-awakening to bed time), wake-to-bed slope, and area under the curve (AUC). In cross-sectional analyses, US-born Latinos had higher wake-up cortisol than immigrants with fewer than 30 years of US residence. In the full sample, over 5 years the CAR and early decline became flatter and AUC became larger. Over 5 years, US-born Latinos had greater increases in wake-up cortisol and less pronounced flattening of the early diurnal cortisol decline than immigrants with fewer than 30 years of US residence. Immigrants with 30 or more years of US residence also had less pronounced flattening of the early decline relative to more recent immigrants, and also had a less pronounced increase in AUC. In sum, we saw limited cross-sectional evidence that US-born Latinos have more dysregulated cortisol than recently-arrived Latino immigrants, but over time US-born Latinos had slower progression of cortisol dysregulation.

### 1. Introduction

Despite facing higher rates of poverty and the challenges of migrating to a new country, Latino immigrants to the US have better health and mortality outcomes than US-born Latinos (Riosmena et al.,

2015). However, this health advantage erodes with increasing duration of residence in the US such that immigrants with longer tenure in the US have higher risk of mortality and poor health than immigrants who arrived more recently (Lariscy et al., 2015). These patterns have been observed across a number of health outcomes, including obesity

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(Sánchez-Vaznaugh et al., 2008), stroke (Moon et al., 2012), and depression/anxiety (Alegria et al., 2008; Cook et al., 2009), and are strongest among Latinos of Mexican origin and in middle age (approximately ages 45–65) (Alegria et al., 2007; Sánchez-Vaznaugh et al., 2008).

Scholars have hypothesized that chronic activation of the body's stress response system may mediate a number of US health disparities, including those observed among US Latinos according to place of birth and, among Latino immigrants, duration of US residence (Kaestner et al., 2009; Viruell-Fuentes, 2007). Chronic activation of the hypothalamic-pituitary-adrenocortical (HPA) axis, a component of the body's response to stress, can have harmful metabolic effects, including higher risk for several conditions that disproportionately affect US-born Latinos and Latino immigrants with longer duration in the US (Champaneri et al., 2012; Hackett et al., 2014; Hajat et al., 2013; Kumari et al., 2010; Matthews et al., 2006). Despite these compelling hypotheses, no studies have examined links between HPA function and nativity/duration of US residence among Latinos.

### 1.1. Nativity/duration of residence and Latino health: stress as a theoretical pathway

Numerous studies have found that newly arrived Latino immigrants have good health despite facing a number of stressors, sometimes terming this the “immigrant paradox” (Salazar et al., 2016; Rubalcava et al., 2008). Some portion of the immigrant mortality advantage may be an artifact of selective migration of healthy immigrants (Rubalcava et al., 2008), undercount of Latino immigrant deaths, or selective out-migration of ailing immigrants (“salmon” bias) (Palloni and Arias, 2004; Patel et al., 2004), but these biases and selection effects do not fully explain the Latino/Hispanic immigrant mortality advantage (Turra and Elo, 2008; Markides and Eschbach, 2005). Another body of scholarship attributes these patterns to the deleterious health effects of “acculturation” or “negative assimilation”, including the decline of protective cultural resources (Gallo et al., 2009; Almeida et al., 2009) and the adoption of unhealthful behaviors over time and generations of US residence (Abraido-Lanza et al., 2005).

However, a number of scholars have argued that a decline in health across time and generations in the United States not “paradoxical” at all in light of the social and structural obstacles faced by many Latinos in the United States (Acevedo-Garcia et al., 2012; Viruell-Fuentes et al., 2012). The cumulative burden of navigating the challenging context for employment, housing, legal status and political resources as an immigrant to the United States (Hall and Greenman, 2014; Hall and Greenman, 2013; Laird, 2015; Torres and Young, 2016) could contribute to the observed declines in health with additional years in the US. Although some immigrants experience improvements in income as they spend more time in the US, these improvements in material circumstances may come at the cost of high-effort striving in adverse circumstances (Viruell-Fuentes, 2007). Furthermore, there is evidence that immigrants may become more attuned to experiences of discrimination and their constructed position within the US ethnoracial hierarchy as they spend more time in the US environment (Viruell-Fuentes, 2011).

While US-born Latinos have the advantage of citizenship and tend to have higher education and income than Latino immigrants, they still experience higher rates of poverty than the general US population, which affects their ability to live in healthy environments and access health-promoting resources (Acevedo-Garcia and Bates, 2008). Many US-born Latinos have family and community connections to the stresses of immigrant life, including acculturative stress and immigration status vulnerability of family, friends or coworkers (Castañeda and Melo, 2014; Quiroga et al., 2014; Viruell-Fuentes and Schulz, 2009). Furthermore, US-born Latinos with increased economic and social integration into the United States may be more conscious of and sensitive to their constructed position, both socioeconomically, and racially/

ethnically, in US social hierarchies (Cook et al., 2009). Experiences of social marginalization may be particularly important for cumulative wear-and-tear on the HPA axis for US-born Latinos: threats to the “social self” are among the most powerful triggers of a HPA response in laboratory settings (Dickerson and Kemeny, 2004), and there is evidence that individuals have more acute reactions to inflammatory language in their first language than in languages acquired later in life (Harris, 2004). Experiences of discrimination while attending school, working, and raising families in settings where Latinos are racialized as “other” and “forever foreign” may be particularly stressful for US-born Latinos (Viruell-Fuentes, 2007). Over time, exposure to a range of social and environmental stressors may wear down bodily systems and leave both Latino immigrants and US-born Latinos vulnerable to disease. These findings have been framed as a “weathering” or “accelerated aging” effect among Latino immigrants with longer US residence and US-born Latinos (Kaestner et al., 2009).

A number of studies have identified nativity/duration differences in stress-mediated physiological measures, including allostatic load (Salazar et al., 2016) and markers of inflammation (Ranjit et al., 2007; Rodriguez et al., 2012). However, no existing studies examine the association between nativity/duration and diurnal cortisol among Latinos.

### 1.2. Diurnal cortisol

The release of cortisol throughout the day (diurnal cortisol) represents a biological marker of the functioning of the HPA axis (Adam and Kumari, 2009; Miller et al., 2007). A typical diurnal cortisol curve consists of a relatively steep increase in salivary cortisol during the first half-hour after waking, followed by a gradual decline over the rest of the day (with some fluctuations after eating and in response to stressors throughout the day), reaching the lowest level in the evening. Diurnal variations in cortisol, particularly the steep increase in cortisol upon wake-up, are essential for healthy functioning, cueing cascades of neuroendocrine signals that mobilize multiple bodily systems (Clow et al., 2010). However, long-term neuroendocrine arousal in response to psychosocial stress may result in chronic, potentially maladaptive alterations of the HPA axis (Sapolsky et al., 1986). These alterations can vary according to the type and chronicity of stress exposure, but generally individuals facing stressors related to social position and social evaluation tend to have higher morning cortisol and flatter declines in cortisol over the course of the day (Miller et al., 2007). The diurnal curve also changes in response to aging, with higher wake-up cortisol, a flatter decline throughout the day, and higher total cortisol output as individuals age (Wang et al., 2014). These aging- and stress-mediated dysregulations in the cortisol curve have been linked in turn to health and mortality risk; for example, a flatter decline in cortisol throughout the day has been associated with higher risk for obesity, diabetes, and cardiovascular disease and higher all-cause mortality (Champaneri et al., 2012; Hackett et al., 2014; Kumari et al., 2011, 2010).

There is a small literature on variation in diurnal cortisol according to scale measures of acculturation or cultural orientation—which are distinct from but tend to be correlated with nativity/duration (Thomson and Hoffman-Goetz, 2009)—in Latino samples. A study of 100 Mexican-American adolescents identified a positive correlation between acculturation and the cortisol awakening response (Zeiders et al., 2012), but a study of 59 Mexican-American adults ages 18–38 found the opposite: that more acculturated individuals had blunted cortisol awakening responses (Mangold et al., 2010). The dynamics of diurnal cortisol vary by age (Karlamañgla et al., 2013), as does association between social exposures and diurnal cortisol (Heaney et al., 2010), which may explain the contrasting findings in these studies of two different age groups. However, these studies use relatively small samples and are cross-sectional. Examining dynamics of diurnal cortisol, including longitudinal dynamics, in a large, late-middle-age Latino sample may offer additional insight into HPA function across time and generations.

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