Life events trajectories, allostatic load, and the moderating role of age at arrival from Puerto Rico to the US mainland

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ABSTRACT

Our aim was to examine the effects of trajectories of stressful life events on allostatic load, measured over a two year time period, and to investigate the roles of language acculturation and age at migration in this association, in a sample of Puerto Rican migrants. We used data from the Boston Puerto Rican Health Study; a population-based prospective cohort of older Puerto Ricans recruited between the ages of 45 and 75 years. The Institutional Review Boards at Tufts Medical Center and Northeastern University approved the study. We used latent growth mixture modeling (LGMM) to identify different classes of two-year trajectories of stressful life events; analysis of variance to examine group differences by stress trajectory; and linear regression to test for the modifying effects of age at arrival on the association of stress trajectory with allostatic load at follow-up. In LGMM analysis, we identified three distinct stress trajectories; low, moderate ascending, and high. Unexpectedly, participants in the low stress group had the highest allostatic load at follow-up ($F = 4.4$, $p = 0.01$) relative to the other two groups. Age at arrival had a statistically significant moderating effect on the association. A reported two year period of moderate but repetitive and increasingly bad life events was associated with increases in allostatic load for participants who arrived to the U.S. mainland after the age of 5 years, and was particularly strong for those arriving between 6 and 11 years, but not for those arriving earlier or later. Results from this study highlight the complex effects of stress during the life course, and point to certain vulnerable periods for immigrant children that could modify long term effects of stress.

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1. Introduction

Identifying factors related to the deterioration of immigrant health following migration is relevant for understanding and reducing existing health disparities among racial and ethnic groups in the United States and other Western societies (Jasso et al., 2004; Williams, 2005). Immigrant populations face unique stressors when transitioning into new societies (Zambrana and Carter-Pokras, 2010). The process of migration and subsequent social adaptation involves novel and stressful experiences such as language barriers, the logistics of moving and changing physical environments, adapting to new values and customs, leaving behind loved ones and other support networks, and changing views of self, an immigrant self, in relation to others (Yakhnich, 2008).

1.1. Allostatic load

Chronic stress exposure may result in high allostatic load, the physiological wear and tear on the body caused by the dysregulation of multiple metabolic systems, including the neuro-endocrine, immune, and cardiovascular systems, in response to environmental stressors over time (McEwen and Seeman, 1999; McEwen and Stellar, 1993). Dysregulation in multiple systems increases the risk of early development of age-related chronic conditions such as hypertension, obesity, and diabetes (McEwen, 1998; McEwen and Seeman, 1999; Seeman et al., 2001). Individual differences in the frequency and quantity of stress exposure as well as the developmental stage of high exposure may influence the patterns of physiological activity and reactivity (Danese and McEwen, 2012; Seeman et al., 2010).

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1.2. Stressful life events

There is growing evidence of the harmful effects of stressful life events on health; however, few studies have examined this association in immigrant populations. In the general population, stressful life events have been found to be adversely associated with chronic diseases such as heart disease, diabetes, obesity and depression (Barry and Petry, 2008; Cutrona et al., 2005; Engstrom et al., 2006; Engstrom et al., 2004; Kendler et al., 1999; Pyykkonen et al., 2010). Recent studies have also found that stressful life events were positively associated with individual biological markers such as cortisol concentration (Karlen et al., 2011; Wong et al., 2012) and with increased odds for metabolic syndrome (Raikkonen et al., 2007). However, limited evidence exists for the effect of stressful life events on multisystem dysregulation, such as that captured by a composite measure of allostatic load, which may precede harmful health outcomes (McEwen and Stellar, 1993; Seeman et al., 1997).

1.3. Migration-related stressors

Stress related to the process of acculturation has been examined in immigrant health research. A number of well-developed assimilation/acculturation theories exist; however, the general expectation is for immigrants to acquire the behaviors and customs of the host society (Viruell-Fuentes et al., 2012). Better outcomes are hypothesized with higher acculturation, but findings on Latino health are mixed and relatively complex (Lara et al., 2005). Although less explored, acculturation may mediate the effects of stress on immigrant health as greater acculturated individuals may have greater access to social resources and therefore greater knowledge of social and institutional resources that may serve to cope with stress (Berry, 1997).

Stressors related to the process of migration (Torres and Wallace, 2013; Viruell-Fuentes et al., 2012) and accompanying social and structural changes are experienced differently depending on the immigrant's age. Immigrant children and adolescents experience stress related to school, peer-pressure, ethnic identity, and family conflict (Hovey, 2000; Patterson et al., 2013; Rumbaut, 2005). Adult immigrants are more likely to experience stress related to dissonant language, the loss of family and other supportive networks, socio-economic difficulties, changes in social status, and perceived racial/ethnic discrimination (Alegria et al., 2008; Link and Phelan, 1995; Takeuchi et al., 2007; Viruell-Fuentes, 2007). Stress related to health problems and feelings of isolation may be more common among older adult immigrants (Patterson et al., 2013).

The process of migration is considered to be a stressful life event (Schwarzer and Schulz, 2003) and for many immigrant children this process may be accompanied by a number of adverse childhood experiences (Oxman-Martinez et al., 2012). Compared to non-immigrant children, immigrant children are at greater risk of experiencing psychological and social isolation, economic hardship, and racial and ethnic discrimination from school peers and teachers (Oxman-Martinez et al., 2012). This additional burden is of consequence given the influential effect of early experiences on the development of social, emotional and cognitive capacities (Eccles, 1999; Knudsen et al., 2006), as well as the lasting changes in multiple metabolic systems found to be associated with high exposure to stress and disadvantaged socioeconomic environments during sensitive developmental periods (Ben-Shlomo and Kuh, 2002; Danese and McEwen, 2012; Eccles, 1999; Hertzman, 1999). Evidence on migration to a new society during middle childhood and/or adolescence, compared to other ages, suggests greater odds of poorer self-rated health (Leao et al., 2009), of mortality from melanoma (Khlat et al., 1992), of becoming overweight (Oza-Frank and Narayan, 2010; Roshania et al., 2008), and higher risk for mood and anxiety disorders (Alegria et al., 2007; Breslau et al., 2009; Patterson et al., 2013; Vega et al., 2004). Nonetheless, no studies have examined the effect of age at migration on allostatic load, a measure that captures the development of multi-system dysregulation over the life course in response to chronic or repeated exposure to stress (McEwen, 1998). .

1.4. Puerto Rican migrants

Puerto Ricans are the second largest Latino subgroup in the United States (Landale, 1994). Unlike other Latino subgroups, the migration of Puerto Ricans is officially classified as internal migration as they enjoy the social and political benefits of U.S. citizenship. However, the magnitude of the migration and cultural, linguistic, racial, and socioeconomic differences have led to a migratory process that is more comparable to that of immigrants from Latin America and the Caribbean than to U.S. internal migrants (Landale and Oropesa, 2001).

Puerto Rico's process of industrialization and economic development in the 1950s, 1960s, and 1970s substantially improved the quality of life of many of its citizens; however, this economic success did not reach a large segment of the population with low education (Falcon, 1990) and was predicated on the out-migration of a large segment of the island's population. High unemployment rates in the island, the demand and active recruitment of labor workers in the mainland, and low airfares facilitated Puerto Rican migration, distinguished by a bilateral flow between Puerto Rico and the U.S. mainland (Duany, 2002; Ramos, 1992). Over time, Puerto Rican migration has been highly sensitive to economic fluctuations on the island and mainland. Further, the ability to travel freely, the social networks, and economic fluctuations have contributed to a very distinctive pattern of circular migration (Duany, 2002; Falcon, 1990). Circular migration is hypothesized to weaken social and family ties, as individuals remain in a state of transitory residence. The socioeconomic and political factors associated with the Puerto Rican migration have influenced the socio-economic characteristics of Puerto Ricans in the U.S. mainland, who tend to have fewer socioeconomic resources than other Latino subgroups (Ramos, 1992).

Despite increased interest in understanding the determinants of immigrant health, most of this research has focused on cultural aspects and factors associated with acculturation. Additional attention to the effect of other social stressors that emerge from contextual structures of inequity and social disadvantage affecting the health of immigrants during their life course is needed.

We created trajectories of stress from reported stressful life events measured at five time points between baseline and approximately two-year follow-up interviews. The primary aim was to examine the association of stressful life events trajectories with allostatic load measured at follow-up. Repeated measures over a two-year period of stressful life events allowed us to examine their cumulative effect, as well as the effect of individual differences in exposure to life stressors on allostatic load at follow-up. The second aim was to test age at arrival and language acculturation as effect modifiers and potential mediators, based on the literature reporting the unique effect that stressors related to the process of acculturation have on the health of immigrants to the U.S. (Caplan, 2007; Guarnaccia et al., 2007).

Following the existing literature, we formulated 4 main hypotheses to be tested:

H1: Given evidence of positive associations between stressful life events and biological markers (Karlen et al., 2011; Raikkonen et al., 2007; Wong et al., 2012), we hypothesized that higher