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Negative Acculturation and Nothing More? Cumulative Disadvantage and Mortality during the Immigrant Adaptation Process among Latinos in the United States

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Immigration scholarship has pointed to many deviations from the notion of a linear, progressive pattern of successful adaptation to the "host" society among immigrants and their descendants. Health is a dimension of wellbeing where these deviations are clear, systematic, and pervasive (Riosmena and Dennis 2012b; Rumbaut 1997). Although immigrants and—to a lesser extent—U.S.-born Hispanics in the United States exhibit relatively favorable health (Cunningham et al. 2008; Markides and Eschbach 2005, 2011), this advantage seems to deteriorate as immigrants gain more experience in the "host" country, and as they and their descendants become more "acculturated" (Hunt, Schneider, and Comer 2004; Lara et al. 2005; Lopez-Class, Castro, and Ramirez, 2011).[1]

Despite being at the forefront of scholarship contesting simplistic notions of immigrants' modes of incorporation, the migrant health literature has nevertheless overly attributed negative adaptation and assimilation to a limited suite of processes classified under the umbrella of "acculturation," the adoption of the host society's mainstream values, attitudes, sentiments, and behaviors and practices. While acculturative behavior may lead to, for example, unhealthy weight gain (Antecol and Bedard 2006; Akresh 2007) and higher

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[1]This deterioration is also contrary to the notion that the difficult decision to relocate across borders is generally aimed to improve the overall wellbeing of immigrants and their offspring.

smoking (Bethel and Schenker 2005; Kimbro 2009)[2]—in turn major risk factors for many chronic health conditions and mortality (Krueger et al. 2004; Mehta and Chang 2009; Rogers et al. 2005)—we argue that the health erosion immigrants and their descendants experience over time may also (and mainly) be related to other, structural forces.[3]

We refer to the amassed effect of these forces under the rubric of "cumulative disadvantage," a term used in the broader health literature to describe the process by which socioeconomic disadvantage and discrimination accrue and compound throughout the life course (Dannefer 2003; Ferraro and Kelley-Moore 2003; Pampel and Rogers 2004). For the immigrant generation, cumulative disadvantage can also refer to the buildup of health problems associated with vulnerable socioeconomic and legal trajectories (Salgado de Snyder et al., in press), which may not be compensated by eventual socioeconomic improvements and legalization. Naturally, cumulative disadvantage affecting immigrant parents may also reverberate into their children's lives during childhood and beyond (for some examples and counterexamples in terms of the opportunity structures of the children of immigrants, see Agius Vallejo 2012; Rumbaut and Portes 2001).

Studies could conflate the role of acculturation with that of these structural forces whenever these two concepts are not separately measured and controlled for (in other words, when analyses do not show the "effect" of moving along an acculturation scale *net* of these structural forces). This may be particularly likely to happen when using cross-sectional research designs that lack measure of these dynamics over time. Because immigrants' income increases as they become more experienced—and thus more acculturated (Chiswick, Lee, and Miller 2005)—cross-sectional measures of socioeconomic status (SES) typically included in these studies may obscure prior episodes of poverty and disadvantage that generate stress and accumulate through life (for a similar argument, see Finch et al. 2009: 492).[4] Further, studies may be otherwise interpreting the effect of proxies of exposure to U.S. society—such as duration of stay or age at arrival—too narrowly as sheer acculturation (see also Abraído-Lanza et al. 2006; Finch et al. 2009; Lopez-Class, Gonzalez Castro and Ramirez 2010).[5]

This paper examines the association between survival during adulthood and Latin American immigrant adaptation using the National Health Interview Survey-Linked Mortality File (NHIS-LMF) from 1998 through 2006. Mortality is an important dimension of health and wellbeing that has been understudied in the immigrant health literature in the context of

[2]In addition to a large body of research on immigrants in the United States, a smaller body of research suggests a similar patterns among immigrant populations in other nations (e.g., McDonald and Kennedy 2004, 2005; Salant and Lauderdale 2003).

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[4]Most longitudinal studies of health in which immigrants and Hispanics are well-represented may not necessarily offer options to solve this conundrum because the baseline survey may be taking place too late to capture some of these dynamics, which tend to take place during the first years after emigration (e.g., in studies of aging, such as Markides and Eschbach [2005, 2011] and Riosmena, Wong, and Palloni [2013], where inclusion criteria include a lower age bound of 50-60 years of age, or in studies of legalized populations, such as Akresh [2007]).

[5]Although scholars have been careful in considering alternative explanations to acculturation and some do not interpret the effects of duration (or even acculturation scales) as only the result of acculturation, acculturation has indeed gained primacy as the main explanation for the negative progression between immigrant adaptation and health (e.g., see Cho et al. 2004; Finch et al. 2009). For other critiques to the concept and measurement of acculturation, see Hunt, Schneider, and Comer (2004), and Lopez-Class, González-Castro, and Ramirez (2011).

immigrant adaptation and assimilation (for exceptions discussed below, see Angel et al. 2010; Colón-López et al. 2009; Choi 2012; and Salinas and Sheffield 2011), particularly with nationally-representative data that thus includes individuals located both in and outside of traditional immigrant or Hispanic enclaves. Further, we contribute to this broader debates on the intra- and inter-generational erosion of immigrant health by providing indirect yet compelling evidence consistent with the idea that acculturation is not the only or may even be the most important mechanism of the deterioration of health among the immigrant generation.

Our results contrasting the immigrant with subsequent U.S.-born Latino generations also contribute to studies of modes of incorporation and racial/ethnic disparities in health. By showing an immigrant advantage in mortality relative to U.S.-born Hispanics even for the most experienced and immigrants, we confirm prior notions of negative “assimilation” in health and wellbeing for the second generation with an understudied and important outcome (for exceptions, see Palloni and Arias 2004). In addition, persistent differences between the most experienced immigrants and their U.S.-born counterparts suggest that the Hispanic Health Paradox (HHP), at least a “weak version” of the HHP as explained below, may lessen but does not fully disappear as immigrants spend more time in the United States.

Before presenting our results, we briefly contextualize our study by describing the state of Hispanic and Latin American immigrant health, followed by a review and critique of the prevailing interpretation of how different measures of immigrant adaptation or acculturation may affect health. We make the case for mortality research in this context as both a good test for other mechanisms, as well as on the grounds of the relative lack of studies in the topic, and discuss how using different measures of immigrant adaptation might tentatively allow us to understand the role of processes other than acculturation.

PREVIOUS RESEARCH

The State of Hispanic and Immigrant Health

Latin American immigrants and, to a lesser extent, U.S.-born Hispanics in the United States have favorable health relative to that of other racial/ethnic groups (for a review and meta-study, see Cunningham, Ruben, and Narayan 2008). Given that both foreign- and U.S.-born Latinos have below-average SES (e.g. Park and Myers 2010), which is generally associated with worse health (Link and Phelan 1995), this favorable result is known as the HHP. In its strongest version, the HHP entails higher survival for Hispanic immigrants than for NH whites, an advantage generally exclusive or otherwise much more prevalent among the foreign-born (Hummer et al. 2000; Palloni and Arias 2004), thus known as the Immigrant Health Advantage (IHA). Nonetheless, the paradoxical nature of Hispanic health does not strictly imply better health relative to non-Hispanic whites; weaker versions of the HHP may imply that Latino immigrants have better health *than expected* given, for instance, their SES levels (Markides and Eschbach 2005; Riosmena, Wong, and Palloni 2013). Likewise, a weak version of the IHA (and, thus, the HHP; see Riosmena, Wong, and Palloni 2013) would be exemplified by more favorable outcomes among immigrants relative to their U.S.-born coethnics, though this comparison is more commonly used as a test for intergenerational assimilation (e.g., Alba et al. 2002).

Several explanations have been advanced to explain the HHP, including substantive mechanisms such as emigration selection and sociocultural protection[6] (Landale, Oropesa, and Gorman 2000; Riosmena, Wong, and Palloni 2013), but also systematic biases, such as data artifacts and the so-called salmon bias, a statistical inflation of mortality/health potentially brought by the selective emigration of the unhealthy back to their countries of origin. Despite the fact that the mortality advantage of Hispanic immigrants is not fully explained by either the artificial deflation of Hispanic death rates by data errors (Markides and Eschbach 2005) or by the selective return migration of the unhealthy (Turra and Elo 2008), these kinds of artifacts could affect estimates of the association between mortality and immigrant adaptation measures, such as duration of stay (for an empirical illustration of these biases, see Riosmena, Wong, and Palloni 2013). We discuss strategies by which we indirectly assess the extent these potential distortions may affect our results throughout the paper.[7]

Immigrant Adaptation in Health Risk Factors, Profiles, and Survival

Immigrant and Hispanic health are negatively correlated with measures of exposure –and arguably, more successful adaptation– to U.S. society, suggesting a deterioration of health throughout the immigrant experience and across generations (at least between first and second). As mentioned at the outset, negative acculturation has been the preferred explanation for these associations. Acculturation implies behavioral change leading to conformity with that of the host society's mainstream, in many cases indeed less healthy than that of recently-arrived immigrants (Antecol and Bedard 2006; Singh and Siahpush 2002). Thus, an acculturation-related explanation is most likely to hold (or otherwise more difficult to disentangle from structural forces) on behavioral risk factors of chronic health such as unhealthy weight gain as well as smoking and drinking. Indeed, duration of stay and acculturation scales are associated with lower consumption of fruit, vegetables, and fiber, and other unfavorable dietary changes (Akresh 2007). Most likely as a result of these changes, these indicators are also correlated with higher body mass (Abraído-Lanza, Chao, and Flórez 2005; Akresh 2007; Antecol and Bedard 2006; Oza-Frank and Cunningham 2010), particularly among women. Smoking prevalence and alcohol use also rise with duration of stay and acculturation levels (Abraído-Lanza, Chao, and Flórez 2005; Kimbro 2009; Lopez-Gonzalez, Aravena, and Hummer 2005), a stronger association for women in the case of smoking (Bethel and Schenker 2005).

[6]The idea of protection is particularly relevant for our purposes. While the favorable health status of Hispanic immigrants may be related to a moderate degree of positive emigration selection (Landale, Oropesa, and Gorman 2000; Riosmena, Wong, and Palloni 2013), studies have also pointed to socially tight, highly segregated Latino communities as protective of health. Several studies have found better health outcomes among Latinos living in neighborhoods with higher concentrations of coethnics (e.g., Cagney, Browning and Wallace 2007; Eschbach, Mahnken and Goodwin 2005; Eschbach et al. 2004; Kimbro 2009; Lee and Ferraro 2007). As some studies have found barrio effects to hold for immigrants (Cagney et al. 2007; Kimbro 2009; but see Lee and Ferraro 2007), immigrants (as well as U.S.-born individuals) may receive some—perhaps short-lived—form of protection before experiencing steadier long-run health declines. Some evidence from studies investigating perinatal health suggests that the deterioration of migrant health may not be monotonic (Teitler et al. 2012), thus suggesting protection could be at play, among other factors discussed below.

[7]Given that biases do not explain the full immigrant mortality advantage, it should then derive from a relatively favorable epidemiological profile. Although this is certainly not the case for several health conditions and risk factors (e.g., Cunningham et al. 2008: Table 1), studies have confirmed this notion for several indicators. Most notably, foreign-born populations exhibit lower prevalence of some chronic conditions, such as hypertension (Singh and Siahpush 2002) and some cancers (Eschbach, Mahnken, and Goodwin 2005). Immigrants also exhibit a lower prevalence of smoking and obesity (Antecol and Bedard 2006; Singh and Siahpush 2002).

Negative behavioral change associated with acculturation could indeed have repercussions for chronic health and mortality because weight gain leading to obesity and heavy smoking are both strongly associated with chronic disease and mortality (Krueger et al. 2004; Mehta and Chang 2009; Rogers et al. 2005). Chronic disease prevalence "increases" with both duration of stay (Singh and Siahpush 2002) and with acculturation (but, unlike health behaviors, more clearly for men; Gorman, Read, and Krueger 2010). Allostatic load, an index of cumulative biological risk related to several types of chronic stress on the body, is higher among immigrants with longer durations of stay (Finch et al. 2009). Disability rates, also associated with several forms of protracted chronic disease, increase with duration of stay (Cho, Frisbie, and Rogers 2004; Singh and Siahpush 2002). Mortality, particularly that attributable to cardiovascular disease, is also negatively associated with duration of stay or age at arrival (Angel et al. 2010; Choi 2012; Colón-López et al. 2009).

Although the negative association between acculturation as well as duration of stay with chronic health and mortality could be exclusively—or, at least, mainly—related to acculturative behavior, this interpretation is more problematic. Other forces related to the socioeconomic and legal vulnerability of many Latin American migrants could affect chronic health in important ways. Deviations from a smoother path to successful intra- and inter-generational adaptation may be taking place among many Hispanic national origin groups in the United States because of structural impediments present in U.S. society (Massey 1995; Rumbaut 1997; Portes and Rumbaut 2001; Telles and Ortiz 2008; Zhou 1997), such as stagnant and decreasing opportunities for socioeconomic mobility affecting most Americans. Many immigrants, particularly those from Latin American, face additional challenges to socioeconomic attainment (e.g., Akresh 2006; 2008) including those by virtue of lack of or being in "gray" legal statuses (e.g., Agius-Vallejo 2012; Hall 2010).

As argued at the outset, these forms of vulnerability may compound over time in a process of cumulative disadvantage. A person's or household's SES at the time of (cross-sectional) interview is a static, post-hoc measurement that could prove insufficient to depict past (and in some cases even present) structures of opportunity or disadvantage (see also Finch et al. 2009). This is precisely more problematic among those seeing socioeconomic progress within and across generations, both stylized facts empirically supported in the immigration literature (Chiswick, Lee, and Miller 2005; Myers, Gao, and Emeka 2009; Park and Myers 2010).

There are at least two main pathways by which cumulative disadvantage may eventually take a toll on chronic health and survival. Higher disability rates associated with duration of stay could be the result of the cumulative effects of engaging in repetitive manual labor or by more acute conditions caused by work-related accidents, which are indeed more common among immigrants (Kirschenbaum et al. 2000; Theodore, Valenzuela, and Menendez 2006) due to poorer working conditions in immigrant-dominated occupations (Orrenius and Zavodny 2009; Theodore, Valenzuela, and Menendez 2006). More importantly, tenuous socioeconomic and legal status also impedes systematic, timely access to quality health care, which in turn may affect chronic health. Immigrants have lower levels of health insurance coverage and less access to regular sources of care than other groups (Derose et al. 2009; Singh and Hiatt 2006), with Hispanics being among those with the lowest coverage

(Rutledge and McLaughlin 2008). Many Hispanics, including the foreign-born in particular, may lack access to private forms of health care because their jobs provide little in the form of health insurance and other benefits (Carrasquillo, Carrasquillo, and Shea 2000), while low wages prevent immigrants from affording health insurance on their own. Immigrants with no, gray, or temporary status—or otherwise recently-acquired permanent residency—may not have access to publicly-subsidized or funded health insurance options for low-SES individuals. Although the children of immigrants born in the United States may have access to several state-sponsored programs such as Medicaid (health care for people with very low incomes) and the State Children's Health Insurance Program (SCHIP, health care for children in families with low incomes but not low enough to qualify for Medicaid) or other programs in which their citizenship gives them access to subsidized forms of health insurance when reaching adulthood (e.g., health insurance exchanges established by the 2009 Affordable Care Act) or old age (Medicare, a universal health program for retired elderly and disabled workers), the foreign-born—particularly those with no or gray legal statuses—have much less access to these programs and subsidies (Chavez, Flores and Lopezgarza 1992; Derose et al. 2009). Despite the fact that health insurance and health care access and utilization seem to improve at longer durations of stay (Lara et al. 2005; Akresh 2009; Angel, Angel and Markides 2002), lack of access among less experienced immigrants can degenerate into poor health due to late detection, poor treatment, and poor control of disease (e.g., diabetes, Otiniano et al. 2006).[8]

The data available to us do not include a time-varying series of SES or other structural indicators, which would allow us to test the cumulative disadvantage hypothesis more directly. Instead, our analytical strategy aims to indirectly assess if negative acculturation is the only/main explanation of the expected negative association between duration of stay and survival. As noted above, we distinguish individuals by nativity (U.S.- vs. foreign-born) as well as the foreign-born by duration of stay in an effort to provide better tests of inter-generational assimilation (in the case of nativity) and as a proxy for a variety of time-graded processes related to the immigrant experience. While this measure is likely correlated with an immigrant's level of acculturation, we try to net out the effects of acculturation by controlling for two sets of variables: behavioral risk factors (body mass, smoking, drinking) and language (of interview). As mentioned above, an unfavorable risk factor profile is oftentimes a marker of negative acculturation processes. Further, language is a central component of acculturation (though not the only one, Lopez-Class, González Castro, and Ramirez 2011).[9] We further control for acquired U.S. citizenship among immigrants.

[8]Some additional, if inconclusive, evidence is provided by studies finding that certain aspects of acculturation are positively associated with health. Bilingualism appears to be associated with more favorable self-rated physical and mental health, an association mediated more by SES and family support than by other acculturation and adaptation measures (Kimbro, Gorman, and Schachter 2012; Schachter, Kimbro, and Gorman 2012). Although Salinas and Sheffield (2011) find a negative association between English use and mortality "after adjusting for health conditions, sociodemographics, and nativity" (p. 232), they did not control for duration of stay or other time indices associated with structural conditions. As we illustrate below (see Table 2), failing to control for these can confound language use with other factors.

[9]Language of interview is the only language variable provided in the NHIS, which specifies whether respondents in the sampled household used English only, English and Spanish, or Spanish only to answer the survey. Although this indicator lacks precision to measure English proficiency, particularly at lower levels of English language aptitude, we regard it as an indicator of at least medium proficiency levels (required in order to be able to answer the NHIS interview) and also of a stronger preference for English among bilingual individuals. Stronger English preference, in turn, may indicate higher levels of acculturation as traditionally understood (for other health studies using this variable, see Gorman, Read, and Krueger 2010; Vadaparampil et al. 2006).

Although this measure that may have an acculturative/behavioral component, we mainly regard it as one mainly depicting legal status.[10]

Because of the multiple epidemiological pathways leading to death, mortality is an outcome in which processes alternative to negative acculturation may be more apparent and, thus, where a signal from other processes may be more clearly visible. If acculturation were the main conduit for the deterioration of health with increasing exposure to U.S. society, one would observe a negative association between mortality and longer duration of stay, English language preference, *and* citizenship. Further, one would expect that the relationship between survival and each of these three measures to be mediated by health behaviors (i.e., including controls for health behaviors should attenuate the "effect" of these measures on mortality). Otherwise, alternative explanations may be more likely depending on the patterns observed for these three indicators combined. If citizenship were not negatively associated with–or if it even were "protective" of–mortality after adjusting for duration of stay and language, this would suggest that a more tenuous legal status may be deleterious for immigrant health. Likewise, if English language preference were associated with higher survival, this could suggest that acculturation may not be an important conduit by which increasing exposure to U.S. society is related to higher mortality.

Our study offers additional contributions to both migrant health and immigrant adaptation studies. Little scholarship has examined survival according to levels of immigrant adaptation. Four primary studies have advanced knowledge of immigrant adaptation and mortality (Angel et al. 2010; Choi 2012; Colón-López et al. 2009; Salinas and Sheffield 2011). Most notably, they used longitudinal data with long follow-ups, thorough death-verification/matching protocols, and used anthropometric measures and chronic health indicators as controls. Whereas NHIS data lacks this depth of indicators, which nevertheless did not explain most of the effects of age at arrival in Angel et al.'s (2010) or Colón-López et al.'s (2009) findings, we depart from them in at least two major ways. First, unlike these studies, which—with the exception of Choi (2012)—used data from regionally-representative cohort studies of Mexican-American older adults, we use nationally representative data that includes additional Hispanic national origin groups. Although Mexican-Americans represent a majority of our sample and public-release NHIS data does not permit the specific identification of several sizable Latin American national origin groups (e.g., Salvadorans and Dominicans are both in the "Other Hispanic" category), the direction and, for the most part, magnitude of most of our results is consistent between Mexicans and other national origin groups combined (see Appendix I).

Past health and immigration scholarship also suggests that men and women have different trajectories of health (Gorman and Read 2006), immigration (Massey, Fischer, and

[10]Like the vast majority of nationally representative surveys in the United States, the NHIS does not differentiate between legal and unauthorized residents. Thus, the noncitizen group includes both. Although citizenship may reflect the level of willingness and level of engagement of immigrants to incorporate to social and political life in the United States, many immigrants face serious barriers to acquire U.S. citizenship. Naturalization is possible only 3 to 5 years after obtaining legal permanent residence, a status unavailable to a large portion of contemporary Latin America immigrants (Riosmena 2010). Thus, interpreting naturalization as a choice and an indicator of acculturation may be short-sighted, especially when considering mortality. Lack of access to citizenship may have direct health consequences because only citizens and legal permanent residents who have spent more than five years in this status can access the most important public forms of health insurance, such as Medicaid and Medicare (Derose et al. 2009). For other health studies using this indicator, see Gorman, Read, and Krueger (2010); Lopez-Gonzalez, Aravena, and Hummer (2005).

Capoferro 2006), and immigrant incorporation (Donato et al. 2008). It is thus logical to assume that acculturation processes in health may differ for men and women (Antecol and Bedard 2006; Bethel and Schenker 2005; Gorman et al. 2010). We therefore examine gender differentials in the association between immigrant adaptation and mortality. However, because few of these associations vary systematically by sex in our data, we only present selected sex-specific results from sex-stratified models or from models using interactions between sex and other measures.

DATA AND METHODS

The NHIS-LMF linked respondents interviewed in the 1986–2004 cross-sections of the NHIS to the National Death Index (NDI) through December 31, 2006. The National Center for Health Statistics (NCHS) determined mortality status through a probabilistic method that is based on combinations of a total of fourteen variables. Records that did not include minimum data for matching were classified as ineligible and were dropped from the analysis. The remaining records were reweighted to represent the U.S. population (NCHS 2009). This prospective data set is suitable for our research because it is a large nationally representative sample that allows more detailed analyses by Hispanic national origin, age, sex, nativity, and duration of residence in the United States; includes a rich and detailed set of covariates measured during the “baseline” interview, including multiple measures of immigrant adaptation and the full range of adult ages; has a long follow-up period; includes a large number of deaths, which allows us to examine overall and some cause-specific mortality risks, and those of some national origin groups; and avoids potential inconsistencies between information (e.g., ethnicity) reported at the time of the Census or survey and at the time of death relative to using vital statistics (for prior studies using the NHIS-LMF to examine general patterns of Hispanic and immigrant mortality, see Borrell and Crawford 2009; Borrell and Lancet 2012).

Beginning in 1989, the NHIS asked respondents how long they had lived in the U.S., while language of interview and citizenship were added in 1998. Because the latter two are key explanatory variables, we restrict our sample to the 1998–2004 NHIS cross sections. Our sample is also restricted to respondents who self-identified as Hispanics, including the U.S.-born as well as all immigrants (that is, foreign-born) individuals for whom we have information on duration of stay. Our total sample consists of 80,472 respondents ages 18 and over (32,960 U.S.-born and 47,512 foreign-born), of whom 2,430 died in the follow-up period. Because mortality is a relatively rare event, the share of deaths in our sample is modest (about 3 percent), but sufficient for multivariate statistical analysis.

Despite its relatively large sample size and the other aforementioned advantages, Hispanic and foreign-born death rates may be underestimated in nationally representative data sets due to lower levels of accuracy in matching criteria, such as name and Social Security number (Lariscy 2011; Patel et al. 2004). While the HHP cannot be fully attributed to data artifacts (Markides and Eschbach 2005), our results could be affected if immigrants with lower “adaptation” levels are less likely to be matched to the NDI. As this is a problem for the most part exclusive of younger immigrants (Lariscy 2011) and may be more likely among groups with higher proportions of undocumented individuals such a Mexicans, we

perform analyses for different national origin groups and cohorts (see Appendices I and II). Because the general patterns we find are overall similar across these groups, we conclude that data and statistical artifacts are likely not driving our interpretation of the data.

We examine whether measures of exposure and adaptation to U.S. society—assessed by duration in the United States, naturalization status, and language of interview—are associated with mortality among Hispanics and by major national origin group (Mexicans, Puerto Ricans, Cubans, and "Other Hispanics"). Table 1 provides weighted descriptive statistics for our working sample by nativity. Over 60 percent of the sample is Mexican, 10 percent is Puerto Rican, 55 percent Cuban, and 24 percent is of "other" Hispanic origin.

In its public-release file, the NHIS includes durations of stay of the foreign-born in five-year categories that are top-coded at 15 years or more. We code duration as a series of dummy variables measuring whether respondents have spent less than 5, 5 to 14, or 15 or more years in the U.S.[11] Just over 50 percent of the foreign-born Hispanic population reports having lived in the U.S. for 15 years or longer, whereas 17 percent reports less than five years' residence; the remaining third reports having come to stay 5 to 14 years before.

Further, 38 percent of foreign-born, non-Puerto Rican, Hispanics are naturalized U.S. citizens. Around 39 percent of the foreign-born Hispanic sample lived in households where the survey was completed exclusively in English, 36 percent exclusively in Spanish, and 19 percent using both languages. Seventy-nine percent of U.S.-born Hispanics lived in households where the survey was answered only in English, whereas 10 percent responded to at least part of the questionnaire in Spanish (half of this 10 percent in Spanish exclusively, half in both languages).

To control for SES in our analyses, we include three measures. First is educational attainment, coded as less than a high school degree, a high school degree, greater than a high school degree, and unknown. Consistent with other studies and data sources showing substantial variation in schooling levels by race-ethnicity and nativity (Everett et al. 2011), the foreign-born have lower educational attainment (54 percent had not finished high school) than the native-born (27 percent had not).

As educational attainment tends to be weakly associated with health and mortality in migrant populations (Riosmena and Dennis 2012a; Kimbro et al. 2008; Turra and Goldman 2007), we also include two other measures of SES: homeownership and poverty status. Poverty status is a dummy variable that captures whether the interviewed household is above or below the U.S. census poverty threshold, a measure based on total family income, family size, and number of children under 18. Homeownership measures whether respondents own or are in the process of buying their home, or respondents do not own their home (referent). Foreign-born persons had higher levels of poverty (18 percent) and lower levels of homeownership (46 percent) compared to native-born respondents (12 percent and 61 percent respectively).

[11]Adjusted Wald tests showed that the hazard ratios (HRs) for respondents who had lived in the U.S. for less than one year and 1-4 years did not differ statistically, nor did the HRs for respondents who had lived in the U.S. 5-9 years and 10-14 years; therefore we collapsed these categories.

We also control for important risk factors of chronic health more closely associated with behavioral and, thus, acculturation pathways. These include body mass index (BMI), alcohol consumption, and smoking. Smoking is coded as a series of dummy variables that measure whether respondents report current or former smoking, or having never smoked (referent). Alcohol use is coded as a series of dummy variables that measures whether respondents are alcohol abstainers (never drinkers, referent), former drinkers, current light/moderate drinkers, current heavy drinkers, or have drinking information missing. We use the World Health Organization (WHO 2000) BMI (kg/m^2) classifications to measure whether respondents were underweight (BMI < 18), of healthy weight (18 ≥ BMI < 25, referent), overweight (25 ≥ BMI < 30), obese class I (30 ≥ BMI < 35), obese class II (35 ≥ BMI < 40), or obese class III (BMI ≥ 40).

Unlike all other indicators, which were collected for all household members during the NHIS household/family interview, these three indicators were only asked to one randomly-selected individual per household (ages 20 and over) as part of a more detailed adult NHIS interview. However, because of the random selection of respondents, we include these indicators in our models and otherwise assume responses are missing at random, allowing us to include a category in each of these three variables indicating observations are missing and estimate all other coefficients without any additional substantial source of bias (Allison 2009).[12] Finally, we also include a dummy indicator for whether respondents were selected into the adult sample.

To assess relative mortality risks across each of our immigrant adaptation measures while controlling for sociodemographic characteristics, we estimate the Cox proportional hazard model provided in Equation 1 where $h(t|X_j)$, the hazard risk for person j at time t conditional on the covariates X_j, is a function of $h_0(t)$, the baseline hazard, the covariates, and the effects of each of these covariates, expressed in β_x:

$$h\left(t|X_j\right) = h_0\left(t\right) exp\left(X_j \beta_x\right) \quad \text{(Eq 1)}$$

Cox proportional hazard models are commonly-used techniques to study mortality risks because they can handle censored observations (with the typical assumption that censoring is "non-informative") and they make no assumptions about the shape of the baseline hazard mortality risk over time. Like other proportional hazard models, they assume that mortality risks for an individual with covariates X_j are proportional to those expressed in the baseline hazard by a factor of $\exp(\beta_x)$, known as hazard ratios (HRs), and that these effects do not vary over time.

Respondents are right-censored if alive by the end of 2006, or coded as dead in the appropriate date. Following Kom, Graubard, and Midthune (1997), we use age at death/censoring as our time scale, t. This implies our model is non-parametric with respect to the age-specific mortality hazards. Because our estimates of duration effects could be

[12]When restricting our analyses to the adult sample, our coefficients remain stable (not shown). Yet, because this restriction implies the loss of a large amount of statistical power, we keep the full sample and assume individual information is missing at random while including a missing indicator for these observations.

confounded with age or migration cohort effects, we test the proportionality assumptions by performing Schoenfeld residual tests and running separate analyses by age groups (Appendix II), in which we do not find strong evidence that duration effects vary by age/cohort.

We keep U.S.-born Hispanics in all of the models presented in Tables 2 and 3 to ensure the stability of our estimates; because the NHIS is representative of Hispanics as a whole, and not of immigrants or the native-born separately; and as nativity did not violate the proportional hazards assumption in our Schoenfeld residuals tests (note that the direction, order of magnitude, and significance of our most important variables remained the same for the foreign-born in those models, as shown in Appendix III). This pooling allows us to obtain more reliable estimates by national origin (Appendix I). We also keep U.S.-born Hispanics to have a population of reference for partially understanding assimilation and testing if the HHP erodes over time (Table 3).

To better illustrate how risk ratios between different groups could translate into survival, we estimate median remaining lifetimes at age 20 for men and women by duration of stay, language of interview, and citizenship status. These figures, known as “half-life” estimates, differ from more conventional life expectancy measures in that half-life represents the median of the distribution of ages at death in the synthetic cohort under study whereas life expectancy represents the mean of the distribution. We use medians instead of means because the former are less influenced by outliers than the former. In our data, outliers in the effect of duration could “distort” life expectancies, for instance, if duration effects were only present among older immigrants. The use of medians is a more conservative approach to understand differences in lifespans by duration of stay and other variables.

Given that Cox proportional hazards models do not provide estimates of the baseline hazard, we employ parametric proportional hazard models to estimate half-life, in which we assume the baseline hazard in Equation 1 follows a Gompertz distribution (a typical assumption in adult mortality studies, e.g., Palloni and Arias 2004). The coefficients of this model (not shown) were not substantially different from those derived from the Cox proportional hazards models.

RESULTS

Immigrant Adaptation and Survival

Table 2 presents results from Cox proportional hazard models regressing adaptation/exposure and sociodemographic and health-behavioral covariates on mortality among Hispanics. All models control for sex, national origin, and SES while introducing the nativity and adaptation/exposure variables separately (Models 1–3) and jointly (Models 4–6). In Model 6 we add health behaviors to test whether their addition alters the results from Model 5.[13]

[13]Appendix V also shows a replication of each of the models presented in Table 2 with controls for health behaviors. Because we find very similar results in either sets of models, we just illustrate these in Table 2 with our most “saturated” model.

Regardless of the model examined, our results show a strong negative association between duration of stay and survival both before and after controlling for other immigrant adaptation measures as well as for health behaviors. Compared to Latin American immigrants with 15 years or more in the country, immigrants with less than 5 and 5–14 years in the country have 38 percent and 13 percent lower risks of dying over the follow-up period (Model 1, $p \leq 0.01$ and $p \leq 0.10$, respectively).[14] These estimates are not reduced but are, if anything, slightly larger (41 percent and 16 percent) after controlling for citizenship and language of interview (Model 4, $p \leq 0.05$ for both coefficients). In both models, mortality is higher for those with medium than shorter durations of stay (e.g., implied in Model 4 relative to those with less than 5 years, $HR = [0.54]^{-1} = 1.42$, $p \leq 0.001$), suggesting that there is a negative duration gradient in mortality. Although the most experienced immigrants have higher mortality than their less experienced counterparts, they do have a lower risk of death than their U.S.-born coethnics. U.S.-born Hispanics have 37 percent higher risks of death over the follow-up period than their foreign-born coethnics with 15 or more years in the country (Model 4, $p \leq 0.001$). Thus, while duration gradients suggest the immigrant mortality advantage may decrease over time, it persists even among the most experienced. We illustrate the order of magnitude of all these differences with our half-life estimates below.[15]

Given the lack of more solid measures of both cumulative disadvantage and acculturation other than SES at baseline and language of interview, respectively, the results for duration could be indicating the combined effect of negative acculturation and cumulative disadvantage. However, the results of our other two measures of immigrant adaptation—acquired citizenship and language of interview—provide some indirect yet compelling evidence suggesting negative acculturation is likely not the main explanation for the negative association between duration of stay and survival.

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[14]Percent differences in mortality risks referred to in the text were calculated using the hazard ratios (HR) in Table 2 in the formula $100 \cdot (HR - 1)$ = percent difference. For example, the percent difference in mortality risks between immigrants with less than 5 and more than 15 years in the United States is equal to: $100 \cdot (0.62 - 1) = -38$ percent (i.e., immigrants with less than 5 years in the United States had 38 percent lower risks of mortality than those with less than 15 years in the United States).

[15]Although at least two types of biases could affect our estimates, particularly those of duration of stay, we do not find evidence suggesting either of these is driving our results. First, right-censoring could bias the coefficients if the censoring process was informative. This does not seem to be the case as the statistical significance of the HRs presented in Table 2 (including those of duration) are robust to censoring the observations two, five, and seven years after follow-up (Appendix IV). Second, as mentioned above, duration effects could be an artifact of return migration attrition. As one would expect the total share of the immigrant cohort returning to the sending country to increase as that cohort ages, this kind of bias would be apparent if the effects of duration were stronger among older than younger individuals, violating the proportional hazards assumption in our models. Schoenfeld residual tests (not shown) do not indicate duration effects vary significantly by age, our time index. As age is top-coded at 85 in the NHIS, we also estimated models for individuals less than 85 (see Appendix II). Results were quite similar to our general model presented in Table 2. Though this suggests duration effects do not differ overall by age, we also estimated models stratified in three major age groups (less than 55, 55-69, and 70 or more) to examine more specific deviations from the general duration patterns that may be of relevance even if they do not influence global tests for the proportionality of hazards (see Appendix II). Duration effects had the same direction and similar order of magnitude among younger and older Hispanics, suggesting selective return attrition is not driving the duration gradient in mortality. However, note that the duration gradient in mortality is indeed weaker, and mostly not significant, for individuals ages 55-69. For instance, among individuals younger than 55 and older than 70, the mortality risks between those arriving less than 5 years and more than 15 years prior to the baseline survey had similar orders of magnitude (HR = 0.46 and HR = 0.59), although only the former was significant ($p \leq 0.001$). In contrast, the HR between people with less than 5 and 15 or more years in the United States was somewhat smaller and not statistically significant among individuals ages 55–69 (HR = 0.82, $p > 0.10$). Likewise, the implied hazard ratio between individuals with 5–14 and less than 5 years in the U.S. is also large and similar for the youngest and oldest cohorts ($HR = 0.81 \div 0.46 = 1.76$ for people less than 55 years-old; $HR = 0.89 \div 0.59 = 1.51$ for individuals ages 70 and over). In contrast, it is much weaker among those ages 55-69 ($HR = 0.84 \div 0.89 = 0.94$). This could suggest that U.S. experience matters differently according to age at immigration, consistent with the findings of other studies only finding, for instance, a mortality disadvantage for those arriving before age 19 (Colón-López et al. 2009).

Both citizenship and language of interview show a much weaker and, perhaps, opposite relationship with mortality compared to duration of stay after controlling for this variable. In the case of language of interview in particular, this suggests that failing to control for this likely proxy of acculturation as well as other processes may lead to confounding acculturation with other forces.[16] Before adding controls for duration of stay and citizenship in Model 2, the mortality risk of individuals living in households where only Spanish was used to answer the NHIS is 11 percent higher over the follow-up period than that of those living in households where the survey was answered only in English, a difference that is not statistically significant. After duration of stay and citizenship status are controlled in Model 4, the risk of death among Hispanics living in households where the survey was answered in Spanish increases to 14 percent and becomes statistically significant ($p \leq 0.01$).

The effects of acquired citizenship, a dummy indicating if an immigrant had naturalized by the time of the survey,[17] also vary substantially after controlling for duration of stay. Before controlling for this variable and language of interview (Model 3), naturalized citizens have 20 percent higher risks of death than noncitizens over the follow-up period ($p \leq 0.001$). This effect, however, becomes slightly negative (i.e., protective with respect to mortality) after controlling for duration of stay and language of interview, though it is not statistically significant (Model 4). Thus, the negative effect of citizenship on mortality in Model 3 seems to be an artifact of the duration composition of naturalized citizens.

The ability and willingness to naturalize may in fact be protective of mortality, at least for women. As shown in Model 5, where we allow for the effects of acquired citizenship to vary by sex, naturalized citizen women have 16 percent lower mortality rates than their non-naturalized female counterparts ($p \leq 0.05$). In contrast, citizenship does not appear to be protective of mortality among men. Male naturalized citizens have 2 percent (i.e., $0.84 \cdot 1.22 = 1.02$, or 2 percent) higher risks of death than their non-citizen counterparts, though this ratio is not statistically significant.[18]

Altogether, these results suggest that language and citizenship do not operate in the way predicted by negative acculturation. As further evidence consistent with this notion, shown in Model 6, neither of the “effects” of our three immigrant adaptation variables—nor that of being born in the United States—change in any substantial way (or almost at all) with the inclusion of controls for BMI as well as smoking and drinking status (see also Appendix V for a replication of Models 1–4 with controls for health behaviors). Before discussing the

[16]While there could be a high degree of colinearity between U.S. citizenship, language, and duration of stay, we found enough variation in the data to separately identify each of these effects. In our data, the distribution of duration of stay is not extremely divergent among immigrants living in households where the NHIS questionnaire was answered in Spanish, dual language, and language unknown relative to those where the questionnaire was answered in English. While indeed the latter had a higher percentage of immigrants with 15 or more years in the United States (56 percent), this number was not overly high when compared to that for households answering the questionnaire in Spanish (45 percent), dual language (45 percent), and unknown language (51 percent). As such, the nonsignificance of some of the language categories in Model 4 are likely not due to colinearity. While the distribution of duration of stay is more concentrated among naturalized citizens (82 percent of them have been in the United States for 15 or more years, compared to 33 percent among noncitizens), there seems to be enough variation to identify the effects of duration of citizenship, language of interview, and duration of stay separately.

[17]In other words, we did not assign citizens by birth, including all Island-born Puerto Ricans, a value of 1 in this variable. Their citizenship is considered separately under the “U.S.-born” variable.

[18]We also separately tested if the effects of language of interview and duration of stay varied between men and women, finding no significant differences in either of these.

implications of these results for immigrant adaptation studies, however, we present the order of magnitude of the "effects" of our different adaptation measures.

Paradox Lost, or Eroded? Order of Magnitude of Differences in Survival

The results presented above suggest that the negative "effect" of duration of stay is stronger than the seemingly protective "effect" of language of interview or citizenship. To illustrate this further in a more tractable way, by calculating the years of life that would be lost or gained if one could manipulate these variables, Table 3 presents differences in half-life at age 20 for males and females. These estimates are derived from our proportional hazards Gompertz models by sex using the same controls as those presented in Model 6, Table 2 (with the exception of sex or its interaction with citizenship).

Compared to Latin American immigrants with 15 or more years in the United States, there is a substantial 4.3 (6.8) year gap in half-life at age 20 among immigrant men (women) with less than 5 years of U.S. experience and a smaller but nontrivial 1.7 (2.1) year gap among immigrant men (women) with 5–14 years of U.S. experience. In contrast, U.S.-born men (women) live 2.4 (2.0) years less than their immigrant counterparts with 15 or more years of U.S. experience. Because there is still a moderate but nontrivial advantage among the most experienced immigrants relative to the U.S.-born for both sexes, this suggests a substantial reduction but not a complete elimination of the immigrant advantage. This is not only consistent with the idea of negative inter-generational "assimilation" in health but also suggests that at least a weak version of the HHP is eroded, yet not completely lost during the immigrant adaptation process.

Differences between duration-nativity groups are somewhat larger than those between naturalized citizens and noncitizen immigrants as well as between people answering the NHIS interview in Spanish only (or both Spanish and English) and those answering it in English only. Half-life at age 20 is 1.7 years longer for immigrant women who became U.S. citizens relative to those without citizenship, again, a nontrivial difference, whereas the difference in half-life between citizens and non-citizens is larger and in the opposite direction among men, these differences were not statistically significant in the underlying models. The higher mortality of individuals living in households where the NHIS interview was answered in Spanish only relative to those answering the questionnaire in English only imply a half-life at age 20 0.1 and 0.8 years lower for men and women respectively. While these variables imply a protective effect for those more acculturated, the difference in half-life is much weaker and inconclusive than those for duration of stay.

DISCUSSION

The striking negative correlation between health and a broad range of duration, acculturation, and adaptation measures has been mostly interpreted in the literature as the result of (negative) acculturation processes (see Hunt, Schneider, and Comer 2004; Lara et al. 2005; Lopez-Class et al. 2011). Yet our results for mortality, a crucial outcome in its own right and one that more clearly identifies possible epidemiological pathways of negative acculturation relative to those of other forces, suggest acculturation is—very likely—neither the only nor the main explanation for the negative association between duration of stay and

chronic health and survival. This is suggested by our findings of a strong association between duration of stay and mortality even after including controls for other immigrant adaptation measures as well as health behaviors. We do *not* find a negative association between survival and either acquired citizenship or language of interview, but rather a protective "effect" of English language of interview for Hispanics of both sexes, and of acquired citizenship for immigrant women. Further, the addition of body mass index, smoking, and drinking –which, in theory, should control for the negative consequences of acculturative behavior– did not change our results for duration of stay whatsoever.

After controlling for citizenship, language of interview, and health behaviors, duration of stay "effects" are less likely to reflect the role of acculturation and more likely to reflect other processes of cumulative disadvantages lived during the adaptation process (Abraído-Lanza et al. 2006; Colón-López et al. 2009). Although our controls for SES during the baseline survey should, in theory, also partially control for some of these disadvantages, they may not fully reflect the extent to which more experienced immigrants have been exposed to them in the past precisely because income and wealth do seem to improve with increasing U.S. experience (Chiswhick, Lee, and Miller, 2005).

Although scholars have considered alternative explanations to the notion that duration of stay or other measures of adaptation –including acculturation scales– are only picking up the effects of acculturation, acculturation has indeed gained primacy as the main explanation for the negative progression between immigrant adaptation and health (e.g., see Cho et al. 2004; Finch et al. 2009). Work within the immigrant health literature has gone to great lengths in designing and validating acculturation scales (Hunt et al. 2004; Lara et al. 2005; Lopez-Class, Gonzalez Castro, and Ramirez 2011), with no similar efforts in the immigrant health literature been devoted towards a deeper, more dynamic understanding of immigrant opportunity structures. Studies have carefully controlled for SES and other factors likely associated with SES. However, given the potential for SES at the time of the survey to be a poor measure of SES throughout the immigrant experience, controlling for SES during a particular time may not be an appropriate adjustment to claim that acculturation is the only or main explanation behind the deterioration of immigrant and Latino health.

Future research aiming to understand the health "behaviors," chronic health, and survival trajectories of immigrants and their descendants should adopt a broader view of the adaptation and assimilation process. For instance, future studies should recognize that even acculturation scales are correlated with structure opportunities, particularly when using cross-sectional data or when baseline surveys take place long time after immigrants' arrival. Such questions would also benefit from longitudinal data and additional biomarker information, which can capture effects of cumulative disadvantage on health (Finch et al. 2009).

Our study provides a more complete portrayal of survival—and, thus, health and certain aspects of wellbeing—through the immigrant adaptation process. Immigration scholars, researchers, and analysts should continue understanding the intricacies of this process beyond negative acculturation arguments, and consider and investigate the more precise ways in which structural forces affect immigrant health. Our results have provided a

provocative and compelling case to go beyond acculturation explanations. Further research should allow practitioners and policymakers to understand how to deal with the root causes of negative adaptation in health among immigrants and thus help preserve the immigrant health advantage for immigrants and reduce the negative health consequences of the "assimilation" of their descendants.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Appendix I: Hazard Ratios for Hispanic Adults by Nativity, United States 1998-2006

	Mexican	Puerto Rican	Cuban	Other Hispanic
Duration of stay (15 or more years)				
Less than 5 years	0.63 *	0.66	0.94	0.19 **
5–14 years	0.85	0.97	0.90	0.77
U.S.-born	1.18 *	1.33 +	1.35	1.96 ***
Naturalized U.S. citizen	0.92	N/A	0.99	0.95
Language of interview (English only)				
Spanish	1.10	1.36 *	1.56 *	1.11
Dual language	1.01	1.30	0.92	0.86
Language unknown	0.90	1.08	1.25	0.97
Male (female)	1.52 ***	1.88 ***	1.69	1.29 *
Schooling (More than high school degree)				
Less than high school	1.28 *	1.48 *	1.19	1.08
High school degree	1.32 **	1.34	1.08	0.96
Unknown schooling	1.00	0.44	1.22	1.03
Below poverty line	1.24 **	1.04	1.11	1.41 *
Missing	0.98	0.95	1.06	1.11
Homeowner	0.84 **	0.76 *	0.82	0.79 *
Smoking Status				
Former Smoker	1.34 **	1.21	1.29	1.27
Current Smoker	1.65 ***	1.76 *	2.08 **	1.81
Missing	2.72 *	7.64 ***	0.86	2.56

	Mexican	Puerto Rican	Cuban	Other Hispanic
Drinking Status (Never Drinker)				
Former drinker	1.16	1.69 *	2.00	1.36
Current light/moderate drinker	0.80 +	0.88	0.57	0.89
Current heavy drinker	1.91 *	1.23	2.02	0.84
Missing	0.51	0.76	---	1.07
Body Mass Index ("Normal" weight)				
Underweight	1.27	--	5.49 *	0.97
Overweight	0.76	1.03	0.85	1.00
Obese class 1	0.82	0.90	0.89	1.12
Obese class 2	0.87	1.64	0.95	1.15
Obese class 3	0.99	1.93	2.04 **	1.07
Not in Adult Sample	1.10	1.93 **	1.04	1.41
No. individuals	50,730	7,063	4,534	18,145
No. events	1,410	279	296	445

Source: 1998-2004 National Health Interview Surveys Linked Mortality File through 2006.

Appendix II: Hazard Ratios for Acculturation Differences in Mortality by Age Groups

	Less than 55	55-69	70 and Over	Less than 85
Duration of stay (15 or more years)				
Less than 5 years	0.46 ***	0.89	0.59	0.61 *
5–14 years	0.81	0.84	0.89	0.80 *
U.S.-born	1.33 *	1.60 ***	1.30 **	1.36 ***
Naturalized U.S. citizen	1.00	0.82	1.01	0.90
Language of interview (English only)				
Spanish	1.31	1.19	1.11	1.16 *
Dual language	0.89	1.11	1.01	0.99
Language unknown	1.01	1.09	0.83	0.93
National origin (Mexican)				
Puerto Rican	0.99	1.58 **	1.34 *	1.31 ***
Cuban	0.76	1.33	1.20	1.12
Other Hispanic	0.66 ***	0.92	0.93	0.80 **
Male (female)	1.55 ***	1.72 ***	1.46	1.60 ***
Schooling (More than high school degree)				
Less than high school	1.39 **	1.38 *	1.04	1.30 **
High school degree	1.31 *	1.20	1.00	1.22 *
Unknown schooling	0.61	1.05	0.88	0.94
Below poverty line	1.28 **	1.53 ***	1.06	1.26 ***

	Less than 55	55-69	70 and Over	Less than 85
Missing	1.32 **	1.00	0.83	1.00
Homeowner	0.75 ***	0.88	0.88	0.81 ***
Smoking Status				
Former Smoker	1.23	1.55 *	1.34 *	1.24 *
Current Smoker	1.57 **	1.20	2.02 ***	1.68 ***
Missing	3.98 ***	64.01 ***	1.28	4.45 **
Drinking Status (Never Drinker)				
Former drinker	1.29	1.69 **	1.20	1.39 *
Current light/moderate drinker	0.90	0.80	0.71 *	0.79 **
Current heavy drinker	1.39	1.63	2.03 *	1.59 **
Missing	0.71	0.04 **	0.97	0.50 +
Body Mass Index				
underweight	---		2.17	1.34
Overweight	0.99	0.82	0.79 *	0.83 *
Obese class 1	1.06	0.85	0.78	0.87
Obese class 2	1.25	0.86	0.96	0.98
Obese class 3	0.95	1.33	1.32 *	1.31 *
Not in Adult Sample	1.24	1.25	1.19	1.18

Source: 1998-2004 National Health Interview Surveys Linked Mortality File through 2006.

Note: referent in parentheses.

+ p ≤ .10.

* p ≤ .05

** p ≤ .01

*** p ≤ .001

Appendix III: Hazard Ratios for Acculturation Differences in Mortality by Nativity Status

	Foreign-Born	U.S. Born
Duration of stay (15 or more years)		
Less than 5 years	0.62 *	
5–14 years	0.88	
U.S.-born		
Naturalized U.S. citizen	0.92	
Language of interview (English only)		
Spanish	1.21 *	0.98
Dual language	1.00	1.02
Language unknown	0.81	1.13

	Foreign-Born	U.S. Born
National origin (Mexican)		
Puerto Rican	1.25 *	1.15
Cuban	1.04	1.07
Other Hispanic	0.63 ***	1.13
Male (female)	1.55 ***	1.60
Schooling (More than high school degree)		
Less than high school	1.11	1.43 **
High school degree	1.06	1.34 *
Unknown schooling	0.77	1.11
Below poverty line	1.14	1.33 **
Missing	1.01	0.99
Homeowner	0.86	0.76 ***
Smoking Status		
Former Smoker	1.16	1.42 **
Current Smoker	1.51 ***	1.97 ***
Missing	3.28 ***	1.02
Drinking Status (Never Drinker)		
Former drinker	1.49 ***	1.16
Current light/moderate drinker	0.80 +	0.76 *
Current heavy drinker	1.71	1.55
Missing	0.93	0.51
Body Mass Index		
underweight	1.68	0.64
Overweight	0.93	0.79 *
Obese class 1	0.80	0.97
Obese class 2	1.33	0.85
Obese class 3	1.41 *	1.04
Not in Adult Sample	1.27 *	1.19

Source: 1998-2004 National Health Interview Surveys Linked Mortality File through 2006.

Note: referent in parentheses.

+ p ≤ .10.

* p ≤ .05

** p ≤ .01

*** p ≤ .001

Appendix IV: Hazard Ratios for Nativity Differences in Mortality Censoring After 2-, 5-, and 7-year Follow-up, United States, 1998-2006

	2 years	5 years	7 years
Duration of stay (15 or more years)			

	2 years	5 years	7 years
Less than 5 years	0.69	0.60 ***	0.62 *
5–14 years	0.91	0.84 +	0.85 +
U.S.-born	1.13	1.28 ***	1.36 ***
Naturalized U.S. citizen	0.92	0.88	0.93
Language of interview (English only)			
Spanish	1.07	1.12 +	1.19 **
Dual language	1.00	0.95	0.99
Language unknown	0.89	0.81 +	0.94
National origin (Mexican)			
Puerto Rican	1.19	1.27 **	1.28 **
Cuban	1.02	1.12	1.12
Other Hispanic	0.69 ***	0.76 ***	0.81 ***
Male (female)	1.71 ***	1.59 ***	1.59 ***
Schooling (More than high school degree)			
Less than high school	1.33 *	1.36 ***	1.30 ***
High school degree	1.06	1.19 +	1.20 *
Unknown schooling	0.87	1.00	0.96
Below poverty line	1.28 *	1.26 ***	1.21 ***
Missing	0.99	1.01	0.97
Homeowner	0.82 *	0.88 *	0.85 ***
Smoking Status			
Former Smoker	1.25	1.30 **	1.26 **
Current Smoker	1.33 +	1.70 ***	2.64 ***
Missing	3.67	2.55 *	1.24 **
Drinking Status (Never Drinker)			
Former drinker	1.59 **	1.28 *	1.36 **
Current light/moderate drinker	0.83	0.74 **	0.80 *
Current heavy drinker	1.84	2.02 **	1.73 *
Missing	0.27	0.68	0.68
Body Mass Index			
underweight	2.48	1.67	1.44
Overweight	0.77 +	0.79 *	0.86 +
Obese class 1	0.64 *	0.88	0.91
Obese class 2	1.26	0.91	1.00
Obese class 3	1.30	1.27 *	1.28 *
Not in Adult Sample	1.29	1.11	1.24 *

Source: 1998-2004 National Health Interview Surveys Linked Mortality File through 2006.

Note: referent in parentheses.

+ p ≤ .10.

* p ≤ .05

** p ≤ .01

*** p ≤ .001

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Table 1

Descriptive Statistics for Hispanic Adults by Nativity, United States 1998-2006

	Nativity		
	All Hispanics	**U.S. Born**	**Foreign Born**
Deceased during follow-up period	2.8	3.0	2.7
National origin			
Mexican	60.4	67.4	55.6
Puerto Rican	10.3	12.6	8.73
Cuban	5.4	2.7	7.3
Other Hispanic	23.9	17.4	28.4
Duration of stay			
U.S.-born	41.0	100.0	
Less than 5 years	9.8	---	16.6
5–14 years	19.3	---	32.8
15 years or more	29.9	---	50.66
U.S. citizenship	63.1	100.0	37.5
Language of interview			
English	57.1	81.2	38.6
Spanish	23.5	5.1	36.2
Dual language	12.9	6.7	18.9
Language unknown	6.6	7.0	6.3
Age (years)	39.4	37.9	40.5
Male	49.4	48.2	50.3
Schooling (More than high school degree)		41.2	23.6
Less than high school	42.8	26.5	54.2
High school degree or equivalent	25.0	31.1	20.7
Unknown schooling	1.4	1.2	1.6
Below poverty line	15.7	12.2	18.2
Missing	24.4	24.0	24.7
Homeowner	51.8	60.8	45.6
Smoking			
Never smoker	26.8	25.3	27.9
Former smoker	6.4	7.2	5.8
Current smoker	7.8	9.8	6.4
Missing	1.8	1.7	1.9
Drinking status			
Never drinker	14.2	10.2	17.1
Former drinker	5.1	5.8	4.7
Current light/moderate drinker	21.7	25.8	18.9
Current heavy drinker	8.9	1.3	0.6
Missing	5.5	0.6	0.5

	Nativity		
	All Hispanics	**U.S. Born**	**Foreign Born**
Body Mass Index (BMI)			
Underweight (BMI < 18.5 kg/m^2)	0.3	0.3	0.3
Healthy weight (18.5 kg/m^2 ≤ BMI < 25 kg/m^2)	13.5	13.6	13.4
Overweight (25 kg/m^2 ≤ BMI < 30 kg/m^2)	15.3	14.8	15.7
Obese class 1 (30 kg/m^2 ≤ BMI < 35 kg/m^2)	6.7	7.8	5.9
Obese class 2 (35 kg/m^2 ≤ BMI < 40 kg/m^2)	2.0	2.8	1.4
Obese class 3 (BMI ≥ 40 kg/m^2)	5.0	4.7	5.3
Not in adult sample	57.2	56.1	58.0
Sample size (No.)	80,472	32,960	47,512
No. of deaths	2,430	1,057	1,373

Source: 1998-2004 National Health Interview Surveys Linked Mortality File through 2006.

Figures are percentages unless otherwise noted.

Table 2

Hazard Ratios for Hispanic Adults, United States 1998-2006

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Duration of stay (15 or more years)						
Less than 5 years	0.62 *			0.59 *	0.59 *	0.59 **
5–14 years	0.87 +			0.84 *	0.83 *	0.84 *
U.S.-born	1.28 ***			1.37 ***	1.36 ***	1.35 ***
Naturalized U.S. citizen			1.20 **	0.94	0.84 *	0.84 *
Male · Naturalized U.S. citizen					1.22 +	1.23 †
Language of interview (English only)						
Spanish		1.01		1.18 **	1.18 **	1.18 **
Dual language		0.88 +		1.00	1.00	1.00
Language unknown		0.90		0.95	0.95	0.96
National origin (Mexican)						
Puerto Rican	1.22 **	1.14 +	1.09	1.28 **	1.28 **	1.27 **
Cuban	1.12	0.96	0.97	1.07	1.07	1.12
Other Hispanic	0.82 **	0.77 ***	0.78 ***	0.83 **	0.83 **	0.83 **
Male (female)	1.63 ***	1.63 ***	1.63 ***	1.62 ***	1.38 **	1.33 ***
Schooling (more than high school degree)						
Less than high school	1.36 ***	1.28 ***	1.32 ***	1.32 ***	1.33 ***	1.28 ***
High school degree	1.23 *	1.22 *	1.22 *	1.22 *	1.23 **	1.20 *
Unknown schooling	0.97	0.91	0.94	0.96	0.97	0.93
Below poverty line	1.28 ***	1.27 ***	1.27 ***	1.26 ***	1.26 ***	1.23 ***
Missing	1.00	1.00	1.00	1.00	1.00	1.00
Homeowner	0.80 ***	0.85 ***	0.83 ***	0.81 ***	0.81 ***	0.83 ***
Smoking status						
Former smoker	--	--	--	--	--	1.27 ***
Current smoker	--	--	--	--	--	1.77 **
Missing	--	--	--	--	--	2.59 **
Drinking status (never drinker)						
Former drinker	--	--	--	--	--	1.33 **
Current light/moderate drinker	--	--	--	--	--	0.79 **
Current heavy drinker	--	--	--	--	--	1.62 *
Missing	--	--	--	--	--	0.63
Body Mass Index ("healthy" weight)						
Underweight	--	--	--	--	--	1.31
Overweight	--	--	--	--	--	0.85 *
Obese class 1	--	--	--	--	--	0.88

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Obese class 2	--	--	--	--	--	1.03
Obese class 3	--	--	--	--	--	1.25 *
Not in adult sample	1.07 +	1.06	1.06	1.09 +	1.09 +	1.22 *

Source: 1998-2004 National Health Interview Surveys Linked Mortality File through 2006.

Note: referent in parentheses.

N=73,369 (2,234 deaths) for all models.

† p ≤ .10.

* p ≤ .05

** p ≤ .01

*** p ≤ .001

Table 3

Gender-specific differences in predicted half-life at age 20 according to duration, citizenship, and language of interview among Hispanic adults, United States 1998-2006

	Men	Women
Duration of stay (15 or more years)	Difference (S.E.)	Difference (S.E.)
Less than 5 years	4.3 (0.05)	6.8 (0.05)
5–14 years	1.7 (0.04)	2.1 (0.04)
U.S.-born	−2.4 (0.03)	−2.0 (0.03)
Naturalized U.S. citizen (Non-citizen)	−0.4 (0.05)	1.7 (0.04)
Language of interview (English only)		
Spanish only	−0.1 (0.03)	0.8 (0.02)
Dual language	−0.1 (0.03)	0.8 (0.02)
No. individuals	36,292	39,862
No. events	1,306	1,110

† $p \leq .10$.

* $p \leq .05$

** $p \leq .01$

*** $p \leq .001$

Source: 1998-2004 National Health Interview Surveys Linked Mortality Files through 2006.

Estimates based on parametric proportional hazards models stratified by sex with a Gompertz baseline hazard with the same controls as shown in Table 2 (except for sex).