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Introduction

Social science research has documented numerous trends in the health of U.S. Latinos, and, increasingly, has examined differences in health indicators within the Latino population by nativity and national origin (Abraido-Lanza et al 1999; Palloni & Arias 2004). Studies have focused on the health and mortality advantages and disadvantages that U.S. Latinos experience relative to non-Hispanic whites, and in some cases African Americans, with whom they share a similar socioeconomic profile (Winkleby & Cubbin 2004). This research is grounded in socioeconomic status (SES), in that U.S. Latinos sometimes exhibit different health patterns than would be expected, given their socioeconomic profile (Collins & Shay 1994; Winkleby & Cubbin 2004).

Health differences between U.S. Latinos and other racial and ethnic groups are frequently characterized by the advantages or disadvantages that remain after controlling for various socioeconomic indicators. This literature has given less attention to comparison of the significance and magnitude of socioeconomic differentials in health between racial and ethnic groups, the scope of these patterns, or the underlying reasons for disparities. Recent research has begun to extend analysis beyond controls for SES to explicitly examine these differentials for U.S. Latinos in comparison to other groups (Goldman et al 2006). This work builds on a large body of research that documents the increased health benefits that come from rising SES, commonly measured by education, income, and/or occupational standing (Adler & Ostrove 1999; Marmot et al 1991). The association between SES and health occurs at each and every level of the socioeconomic ladder—not only do those in poverty have poorer health than those who are more advantaged, but those with higher SES enjoy better health than those just below them in the social hierarchy, a pattern known as a "social gradient" (Adler et al 1994).

However, the responsiveness of health outcomes to SES among some U.S. Latino groups may diverge from this conventional pattern. In a recent study, Goldman et al (2006) have suggested that socioeconomic differentials are weaker or even absent for numerous health-related indicators among Mexican Americans in comparison to the non-Hispanic white population. That is, Mexican Americans may not receive the same health benefits as non-Hispanic whites in relation to increases in their SES. These findings are consistent with those of other studies that have found more modest SES effects for U.S. Latinos for mortality, a number of diseases and disease risk factors, birth outcomes, and health behaviors among adolescents and adults (Acevedo-Garcia et al 2005; Crimmins et al 2004; Gordon-Larsen et al 2003; Khan et al 1997; Sharma et al 2004; Turra & Goldman 2005; Winkleby & Cubbin 2004). While weaker social gradients may be a sign of less health inequality within the U.S. Latino population, and as such might be viewed in a positive light, they also suggest that health disparities may grow between U.S. Latinos and non-Hispanic whites as the socioeconomic profile of U.S. Latinos improves (Goldman et al 2006).

Some of the difference in the effect of SES on health outcomes and behaviors between non-Hispanic whites and Mexican Americans appears to be explained by nativity (Goldman et al 2006). Statistical comparisons suggest that education gradients for adults born in Mexico ("Mexican immigrants") are significantly weaker than those for non-Hispanic whites, including those for smoking, heavy drinking, overweight or obesity, work limitations, and depressive symptoms (Goldman et al 2006). Some of the differences are quite large, particularly for smoking; the negative effect of education for whites on smoking was substantial but that for Mexican immigrants, although still negative, was comparatively small (Goldman et al 2006).

If nativity is a source of the disparities in education-health gradients between non-Hispanic whites and Mexican Americans, then this raises the question as to the mechanisms involved. It has been suggested that social gradients for some health behaviors in Latin America are weak or reversed relative to those in the United States (Goldman et al 2006). That is, in some Latin American countries, unhealthy behaviors may increase rather than decrease as education and income rise. Although increased income and wealth enable individuals to lead a sedentary life, to eat richer diets and more food, and to purchase cigarettes and alcohol, it is lower SES individuals in countries like the U.S. who are more likely to be obese, to smoke, and to have unhealthy drinking patterns – presumably because high SES individuals take action to restrict unhealthy behaviors (Adler & Ostrove 1999; Winkleby et al 1992). In addition, the level of poverty faced by the poor in developing countries is often considerably greater than in the United States. For this reason, for example, malnutrition rather than obesity has been the primary nutritional problem in many developing countries, at least until recently (Popkin 2001). Moreover, lower SES individuals in Latin America may be less able to afford to purchase cigarettes and alcohol and to find sedentary occupations. Thus, social gradients in health behaviors in developing contexts are likely to be "reversed" (i.e., poor people are *less* likely to be obese and to smoke). Social gradients may also be flatter (i.e., there is little or no difference in health behaviors by SES) because although the poor in developing countries are exposed to higher health risks (e.g., infections, injuries) and have poorer health care than higher SES individuals, they may also be less likely to have detrimental health behaviors.

There is empirical evidence that social gradients are reversed for some health behaviors in some developing countries in Latin America. For example, there is evidence of reverse gradients in Mexico for smoking among adults and adolescents (Antonio-Rincón et al 2002;

Caballero et al 1999; Vázquez-Segovia et al 2002). Studies have also found that higher SES is associated with greater obesity prevalence in some Latin American countries, which is attributed to the process of economies transitioning out of poverty (Kain et al 2003; Martorell et al 1998; Pena & Bacallao 2000; Rivera & Seplveda Amor 2003). However, even in those Latin American countries where a reverse gradient is not evident, higher SES may only slightly reduce the risk of obesity, if at all (Kain et al 2003). This appears to be the case in Mexico, where one study found no reduced risk of obesity among middle and higher SES women aged 15 to 49, although a statistically significant negative relationship was observed for primary or no education versus secondary education or higher (Martorell et al 1998). Sometimes the effect of higher SES on obesity varies by the level of economic development within regions of Latin American countries, with less developed regions exhibiting a reverse (positive) gradient and more developed regions a negative gradient (Monteiro et al 2002).

Research questions and hypotheses

Taken together, this evidence raises the possibility that the Mexican immigrant population in the U.S. may have established reversed or weak social gradients for health behaviors in Mexico, which they then brought with them to the U.S. via immigration. This paper investigates this possibility, with the aim of identifying potential determinants of the shape of education gradients in the general Mexican American population. Specifically, I examine hypotheses related to the influence of Mexican gradients on Mexican immigrants for three health indicators—smoking, overweight and obesity, and binge drinking.[1]

The first hypothesis concerns age at immigration and the initiation of risky health behaviors. Risky health behaviors, such as smoking and excessive alcohol consumption, which

[1] Although overweight and obesity is an indicator of health status linked to health behaviors such as diet and exercise, for convenience it is referred to here as a health behavior.

contribute to the leading causes of mortality and morbidity among adults, are often established during adolescence, extend into adulthood, and are interrelated (Grunbaum et al 2002; Millstein et al 1992). Besides these traditional risk behaviors, adolescents have increasingly become at risk of overweight and obesity in the United States and, although data is scarce, in some parts of Latin America (Baskin et al 2005; Eaton et al 2006; Grunbaum et al 2002; Wang et al 2002). A high prevalence has been reported among Mexican children and adolescents, although their levels of overweight and obesity are only about half as high as in the U.S. (del Rio-Navarro et al 2004). Although the determinants that shape risky health behaviors in adolescence are not well understood, the social context of adolescents, as well as individual characteristics, have been found to influence health behaviors (Resnick et al 1997).

My first hypothesis assumes that not only risky health behaviors, but also the socioeconomic gradients for these behaviors are formed in childhood and adolescence. I hypothesize that age at immigration is a determinant of social gradients for smoking, overweight and obesity, and binge drinking. I examine this hypothesis by comparing education gradients for health behaviors of Mexican immigrants that immigrated to the U.S. during childhood and adolescence ("early migrants") versus those who immigrated at later ages ("later migrants"). This hypothesis rests on the assumption that the social gradients for health behaviors among later migrants were shaped by those prevailing in Mexico during their childhood and adolescence. The gradients of early migrants, in turn, should be more subject to prevailing patterns in the U.S. during their childhood and adolescence, which implies that they will exhibit gradients more similar to those of the general U.S. population. If this hypothesis holds, then the weaker SES effects on health seen in the general Mexican American population in comparison to non-

Hispanic whites would be more strongly influenced by SES patterns among later migrants (Goldman et al 2006).

The second hypothesis is also related to Mexican influences on education-health behavior gradients among Mexican immigrants. If Mexican immigrants are in fact bringing social gradients with them as they immigrate, then this should be most evident closest to the time of arrival. That is, more recent immigrants should exhibit a reversed, flat, or weaker education gradient for various health behaviors in comparison to those with longer residence in the U.S. This hypothesis rests on the assumption that acculturation and assimilation processes begin to influence the shape of social gradients of Mexican immigrants, as length of residence increases. With a longer period of residence, the social gradients of the Mexican immigrant population should begin to resemble those of the general U.S. population, with higher SES individuals exhibiting healthier behaviors than those with lower SES. If this hypothesis holds, then the weaker education gradients seen in Mexican Americans in comparison to non-Hispanic whites would be most strongly influenced by Mexican immigrants in greater proximity to arrival in the U.S.

This study investigates the following research questions 1) Do Mexican immigrants who immigrated at later ages exhibit weaker education gradients for smoking, overweight and obesity, and/or binge drinking than those who immigrated in childhood or early adolescence? 2) Do Mexican immigrants in greater proximity to arrival in the U.S. exhibit weaker education gradients for smoking, overweight and obesity, and/or binge drinking than those with longer residence in the U.S.?

Weaker, flat, or reversed gradients among later and more recent migrants would offer evidence of the influence of Mexican gradients on those of the general Mexican American

population. The evidence for the hypotheses outlined above is strongest for smoking. Previous research has established that the non-Hispanic white-Mexican immigrant gradient differential is quite substantial for smoking; that is, Mexican immigrants exhibit a much weaker (although still negative) education-smoking gradient than non-Hispanic whites (Goldman et al 2006). In addition, several studies from Mexico have found a positive association between smoking and SES (Antonio-Rincón et al 2002; Caballero et al 1999; Vázquez-Segovia et al 2002). For these reasons, I expect that the results for smoking will yield clearer evidence of the influence of Mexican gradients on the health behavior patterns of Mexican immigrants, and in particular for the hypothesis comparing early and later migrants, given that smoking tends to be initiated in adolescence. Although statistically significant differences in education gradients have been found for Mexican immigrants in comparison to non-Hispanic whites for overweight and obesity and binge drinking (Goldman et al 2006), the differences are slight and there is less research on SES differentials for binge drinking and overweight and obesity in Mexico, for either adults or adolescents.

Data and Methods

Data for this study come from the National Health Interview Survey (NHIS), a nationally representative cross-sectional survey of the civilian, non-institutionalized population of the United States conducted annually since 1957. The questionnaire varies slightly from wave to wave, but the items included in this analysis were the same within the period of study. In order to generate a sample size large enough for analysis, I pooled NHIS data from 1998 to 2005.[2]

[2] Prior to 1998, no information was collected on years in the U.S. for foreign-born individuals, a variable which is central to the analysis of the hypotheses investigated here, which precluded the use of earlier waves.

I restrict the analytic sample to the Mexican-origin sample aged 18 and older, because it constitutes the largest Latino group in each survey, and because this paper investigates mechanisms for patterns found in previous research on the Mexican-origin population.

For analysis of the first hypothesis, that of differential effects of education on health behaviors by age at immigration, the analytic sample was defined in part based on limitations in the data made available for public use by the NHIS. I defined "early migrants" as those participants aged 15 and younger at the time of immigration. Age 15 was selected as the cutpoint to ensure that early migrants would have at least a few years of exposure to the social gradients for health behaviors prevailing in the U.S. by the time of the survey (the youngest respondent was age 18). However, earlier studies testing similar hypotheses for Latino immigrants have selected age 10 as the cutpoint, ensuring a longer period of exposure to U.S. patterns (Landale & Hauan 1996). While an earlier age cutoff would have been preferable, this would have imposed severe restrictions on sample size for this analysis. This is because the public use data on number of years of residence in the U.S., a variable necessary to establish age at immigration, is available only in intervals (less than 1 year, 1 to 4 years, 5 to 9 years, 10 to 14 years, and 15 years or more), which makes it is impossible to determine the precise age at immigration. Moreover, I could not determine whether those who had been in the U.S. for 15 years or more were early or later migrants, past a certain age, depending on the cutpoint. I chose 15 as the cutpoint for early migration, and included only those participants 30 and under, so that I could determine the approximate age of migration for all participants for each of the intervals of years in the U.S.[3]

[3] If I had included participants past age 30 in the sample, it would be impossible to determine if those who had been in the U.S. for 15 years or more were early migrants or later migrants. For example, participants who were age 31 at the time of the survey and had been in the U.S. for 15 or more years could have immigrated at age 16, if they had been in the U.S. for exactly 15 years, making them later migrants. However, they also could have immigrated at age 15 or younger, if they had been in the U.S. for 16 or more years, making them early migrants. This was true of participants with 15 or more years in the U.S. for any age over age 30. However, for those 30 and under, all

The selection of an earlier cutpoint would have necessitated restricting the sample to an even smaller age range. While this is an unfortunate limitation, and results in the exclusion of a substantial number of cases from analysis, the hypothesis rests on the idea that social gradients for the three health behaviors studied here are adopted in childhood and adolescence; therefore, these gradients should be evident in a sample aged 18 to 30. Thus, while coefficients may be biased downward somewhat in size, the overall direction and significance may be detectable in this restricted sample.

For similar reasons, I restricted the sample for analysis of the second hypothesis, that of differential effects of education on health behaviors for Mexican immigrants by proximity to arrival in the U.S., to those older than age 30. I did so primarily in order to avoid confounding hypotheses concerning proximity to arrival with early immigration. If early migrants were included, education gradients by years in the U.S. would reflect the influence of both U.S. and Mexican gradients on health behaviors. For the same reasons described above, it was impossible to know if those who had been in the U.S. for 15 or more years were early or later migrants before age 31. Thus, I excluded those 30 and under from analysis of this hypothesis and those of any age who had been in the U.S. for 15 or more years.

The decision to exclude early migrants from the sample for this second hypothesis means that it builds on the assumptions of the first; it is also a test, in a manner of speaking, of the effect of Mexican influences in childhood and adolescence on the gradients of Mexican immigrants. However, it enhances our understanding of these gradients in several ways. First, this second sample includes those participants over 30 at the time of the survey, who are excluded from the first sample, so it provides a sense of the influence of Mexican gradients on later migrants that

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participants who indicated that they had resided in the U.S. for 15 or more years could be correctly categorized as early migrants.

may be more evident at older ages. Even though gradients might be formed in adolescence, they may more clearly manifest themselves for some health behaviors later in life. Second, it assesses whether education gradients among later migrants are different when in greater proximity to arrival as well as the extent of change, if any, over time in the U.S. Thus, the test of this hypothesis not only provides information about the contribution of *newer* immigrants to overall Mexican American gradients, but also the *relative* contribution of immigrants at various lengths of residence.

Individuals missing information on any of the dependent or independent variables were excluded from analysis. The number of missing observations varied across dependent and independent variables. For example, the percentage of observations with missing information on the dependent variables for the sample for proximity to arrival in the U.S. included approximately 1 percent for smoking, 2 percent for binge drinking, and 9 percent for overweight or obese. The percentages with missing information for the sample for age at immigration were very similar. Sample sizes varied slightly across the different outcomes for each hypothesis because of the differences in amounts of missing data. The sample sizes for each outcome are presented in each table in the appendix.

Study variables

This study analyzed education gradients for three health behaviors, smoking, overweight and obesity, and binge drinking. The dependent variable for smoking was defined as whether adults are current smokers or non-smokers. The variable for current smokers was coded as 1 for current smokers who smoked every day or some days and 0 for those who had never smoked or were former smokers. The analysis used two variables for unhealthy weight, overweight or obese and obese only. Both measures were derived from participants' body mass index (BMI) based on

self-reported height and weight in the NHIS. Participants with BMIs of 25.0 (kg/m^2) or higher were coded 1 for overweight or obese and those with BMIs of under 25.0 (kg/m^2) were coded as 0. Participants with BMIs of 30.0 (kg/m^2) or higher were classified as obese. For binge drinking, participants with consumption of 5 or more drinks on a single day at least once in the past week or month were coded as 1, and 0 otherwise.

The primary independent variables of interest for this study were education, age at immigration, and years in the U.S. Education was defined as a continuous variable in completed years of education. The variable for age at immigration was coded as 1 if participants immigrated to the U.S. at age 16 or older (later migrants) and 0 for those who immigrated to the U.S. at age 15 or younger (early migrants). Because years in the U.S. was coded in intervals, as described above, I chose the most conservative means of categorizing individuals as early migrants. For example, for individuals who were 21 years old at the time of the survey, I categorized only those who indicated that they had been in the U.S. for 10 to 14 years or 15 years or more as early migrants. Those who had been in the U.S. for 5 to 9 years were coded as later migrants, which is a conservative approximation; although 21 year-olds who had been in the U.S. for 5 years (making them 16 at the time of immigration) would correctly be classified as later migrants, those who had been in the U.S. for anywhere from 6 to 9 years would actually be early migrants. Given that this means of defining early versus later migrants is the most conservative under the circumstances, I expect estimates for this variable and its interactions with education to be biased downwards. Years in the U.S. (for the analysis of proximity to arrival) was recoded into 3 categories: less than 5 years, 5 to 9 years, and 10 to 14 years. Control variables included age and gender.

Analyses

I used logistic regression models to determine the magnitude and statistical significance of gradients (i.e., the slopes of the relationship between each health behavior and interaction terms for education and the immigration variables) for the three health behaviors. I estimated separate models for each health indicator. Each model included variables for age, gender, and years of completed education. Models testing the hypothesis for age at immigration included a dummy variable for age at immigration and an interaction term for age at immigration and years of education. Similarly, models that tested the hypothesis for years in the U.S. included dummy variables for 5 to 9 years and 10 to 14 years; the dummy variable for less than 5 years in the U.S. served as the reference category and was omitted. These models also included interaction terms for the two dummy variables for years in the U.S. and education, again with the interaction term for education and less than 5 years in the U.S. serving as the reference category. I included dummy variables for stratum in each model to account for stratification in the sampling scheme. I use the –cluster– option in Stata 9.1 to account for clustering within stratum by specifying the primary sampling unit as the cluster variable in each regression model.

Results

Table 1 presents sample sizes and average values (unweighted) for each of the variables included in the analysis by age at immigration and proximity to arrival. Most notably, years of completed education are substantially higher in the sample among early migrants (12.4) than later migrants (9.5). The mean age and standard deviations among early versus later migrants are similar because the sample is limited to those 30 and under. The mean age for the sample for proximity to arrival is higher in general, and the standard deviations larger, than those for age at immigration because the second sample includes only those who were aged 31 and older at the

time of survey. However, the mean age is quite similar among those who have been in the U.S. for differing lengths of time, suggesting a steady stream of migration at different ages. Smoking is more prevalent among later migrants and those closer to arrival, although the pattern for the latter is not monotonic. Binge drinking appears to be slightly more prevalent among later migrants but does not appear to vary by years in the U.S. Overweight/obesity and obesity only are slightly less common among later migrants in the sample. The proportion of overweight/obese and obese only increases with years in the U.S.

The results of the logistic regression analysis are reviewed below by health behavior, rather than by hypothesis. Tables 2 through 5 provide the results for smoking. Tables 2 and 3 present coefficients and predicted probabilities for the test of the first hypothesis, that the effect of education on smoking will be weaker, absent, or reversed for later migrants as compared to early migrants. These results provide support for this hypothesis. A Wald test confirms that the model with the interaction term provides a significantly better fit to the data (X^2=13.10, p=0.000).

As seen in Table 2, the interaction term for education and later migration is positive and statistically significant, indicating that each additional year of education increases the log odds of smoking among later migrants. To make these results easier to interpret, Table 3 provides the predicted probability distribution for smoking for Mexican immigrants 30 and younger. Among later migrants, those who completed college have an 18 percent probability of smoking, whereas those with a primary education have a 15 percent probability of smoking. In contrast, the education gradient among early migrants is negative and stronger, with those with a college education having a 6 percent lower probability of smoking than those with a primary education.

These data suggest that social gradients for smoking among Mexican immigrants aged 30 and younger are influenced by prevailing patterns in the country of residence during childhood and adolescence. Moreover, they suggest that later migrants influence the education-smoking gradient for the Mexican American population differently than do early migrants. The positive gradient for later migrants may temper the negative gradient for early migrants, and perhaps that among U.S.-born Mexican-origin individuals, to produce a weaker education-smoking relationship for the general Mexican American population, in comparison to that seen among non-Hispanic whites (Goldman et al 2006). However, it is important to note that a weaker, although still negative, gradient among early migrants might also moderate the strength of the overall Mexican American education-smoking gradient, although investigation of this possibility is beyond the scope of this study.

Tables 4 and 5 provide results for the test of the second hypothesis for smoking—that the effect of education on smoking will be weaker, absent, or reversed for Mexican immigrants in greater proximity to arrival in comparison to those with more years of residence in the U.S. The results presented in Table 4 do not provide support for this hypothesis. A Wald test of the significance of the set of interaction terms suggests that this model does not provide a better fit to the data than the simpler model (X^2=0.00, p=0.995). The insignificance of the interaction terms indicate that there is no difference in the effect of education on smoking for individuals who have been in the U.S. for less than 5 years (the reference category) in comparison to those here for either 5 to 9 years or 10 to 14 years.

Because the second analysis excludes those 30 and under who might be later migrants as well as those with longer durations in the U.S. (15 or more years), it may not offer a robust test of this hypothesis. However, assuming that this sample does provide a reasonable test, results

suggest that proximity to arrival may not explain the weaker effect of education on smoking for Mexican immigrants, and for Mexican Americans in general, relative to whites, found in recent research (Goldman et al 2006). Instead, age at immigration may offer a better explanation. Education gradients for smoking, as suggested by the first analysis, may be formed and acted upon during adolescence; combined with the highly addictive nature of smoking, the effect of education on smoking may not differ much for later migrants after that period, regardless of the number of years spent in the U.S. exposed to different SES-health patterns.

Tables 6 through 11 provide the results for tests of both hypotheses for overweight and obesity. Coefficients and predicted probabilities for the first hypothesis, age at immigration, are presented in Tables 6 and 7, respectively. Although the interaction term is in the expected direction (positive) for overweight and obesity (Table 4), it is not statistically significant, indicating that there is no difference in the effect of education on overweight and obesity for later versus early migrants. A Wald test confirms that the model with the interaction term does not provide a better fit to the data (X^2=0.08, p=0.783). Results did not differ for the analysis of obesity only, and so are not shown here.

However, the effect of education does appear to be weaker in greater proximity to arrival, as shown in Tables 8 through 11. These results are clearest for the analysis of obesity only (Tables 10 and 11). As Table 10 shows, the effect of education on the log odds of being obese is weaker for those who have been in the U.S. for less than 5 years, in comparison to those with longer residence. This is indicated by the negative and statistically significant coefficients for the interaction terms for education and the other two categories for years in the U.S. (5 to 9 years and 10 to 14 years). Those who have been in the U.S. for 5 to 9 years or 10 to 14 years are *less* likely to be obese with every additional year of education than those in the U.S. for less than 5

years. A Wald test of the set of interaction terms confirms that the model with interactions provides a better fit to the data (X^2=30.16, p=0.000).

The predicted probabilities (Table 11) provide a sense of the magnitude of the education-obesity gradients for different lengths of residence in the U.S. for later migrants aged 31 and older. As the table shows, for those who have been in the U.S. for less than 5 years, there is little change in the probability of obesity between those with a 6th grade education and those with a college education, suggesting a flat (absent) education gradient among recent immigrants. However, at both 5 to 9 years and 10 to 14 years, this relationship shifts, looking more like the pattern seen in non-Hispanic white population. In fact, the education-obesity gradient becomes even steeper after 10 years in comparison to that for 5 to 9 years. The difference in the probability of obesity among those with a college versus a primary education is 4 percent after 5 years, but is 10 percent after 10 years.

The lack of an education gradient for obesity among recent immigrants may be one source of the weaker education gradients for overweight and obesity seen in the Mexican American population, in comparison to non-Hispanic whites (Goldman et al 2006). It is important to note, however, that those who remain in the U.S. after 5 years may be a select group. Those with a weaker association between education and obesity may return to Mexico soon after arrival for a number of reasons, such as health issues and lack of success in the job market. If this is the case, then selection, not the stronger influences of Mexican gradients on recent arrivals, may lie behind these results.

The lack of consistency in results for the first and second hypotheses may be due to sample restrictions. The sample for age at immigration was restricted to Mexican immigrants aged 30 and under, whereas that for proximity to arrival included those 31 and older. Although

education gradients linked to obesity, such as gradients for less healthy diets and lack of exercise, may be shaped in childhood and adolescence, they may be more clearly manifested later in life. The prevalence of overweight and obesity increases significantly after age 30 (Flegal et al 1998). Thus, the second sample, which includes older individuals, may provide a clearer test of the influence of Mexican gradients on obesity. In addition, the formative period for education gradients linked to unhealthy weight may not be restricted to adolescence; it may extend into the 20s and beyond, which would be more evident in an older sample.

The gradients in Table 10 and 11 suggest that Mexican American/non-Hispanic white education disparities for obesity are most influenced by those in greater proximity to arrival. However, the patterns in Table 10 provide additional insight: These gradients change over time, based on years in the U.S. Without such shifts, which suggest the influence of American SES-health patterns on Mexican immigrants, the disparities between Mexican American and white gradients would likely be even larger. In addition, these results imply that any tempering of the Mexican American obesity gradient comes not only from those in their first 5 years of residence, but also from those in residence for longer than 5 years, albeit at a decreasing rate. This is because the education-obesity gradient increases monotonically by years in residence.

Tables 12 through 15 provide the results for the tests of the hypotheses for binge drinking. There is no evidence that the education gradient for binge drinking varies by age at immigration, as shown by the non-significance of the interaction term in Table 12. A Wald test confirms that the model with the interaction term does not provide a better fit to the data (X^2=1.18, p=0.277). Past research in this area has suggested that increasing education does not have an effect on the likelihood of binge drinking, similarly defined, for either Mexican immigrants or Mexican Americans in general (Goldman et al 2006). The interaction term

suggests that age at immigration is not the source of this flat education gradient among the larger Mexican immigrant, as well as Mexican American, population. Factors other than age at immigration may be influencing the Mexican American education gradient, such as selective migration or population composition.

Tables 14 and 15 provide the results for education and years in the U.S. for binge drinking. These tables show that results for later migrants aged 31 and older are somewhat mixed. Education has a *positive* (and statistically significant) effect on binge drinking for those with 5 to 9 years in the U.S., relative to its effect for those who have been in the U.S. for less than 5 years. That is, with each additional year of education, those closer to arrival are *less* likely to engage in binge drinking than those who have been in the U.S. for somewhat longer. However, there is no difference in the effect of education for 10 to 14 years versus less than 5 years of U.S. residence, indicated by the non-significance of this interaction term. This is contrary to my hypothesis, which predicted that the effect of education would be reversed (positive), flat, or weaker (rather than negative) for binge drinking for those in greater proximity to arrival.

Table 15, which presents the predicted probability distribution for binge drinking, provides a clearer picture of these patterns. As the table shows, those with greater proximity to arrival (less than 5 years) have a negative education gradient for binge drinking, i.e., those with a college education are less likely to binge drink than those with a primary school education. However, between 5 and 9 years in the U.S., this relationship seems to reverse, with high school or college graduates *more* likely to binge drink than those with a primary school education. This relationship is not monotonic; those with a high school education having the highest probability of binge drinking. At 10 to 14 years, the gradient appears to become negative once again, with

those with a college education being less likely to binge drink than those with a primary education, which is similar to the pattern for those in the U.S for less than 5 years (although the two categories are not statistically significantly different).

Results from both analyses suggest that gradients for binge drinking may follow a different pattern than gradients for other health behaviors, in relation to U.S. and Mexican influences. As stated earlier, recent research has suggested that education does not have an effect on binge drinking for Mexican immigrants (Goldman et al 2006). These results provide some evidence that this education effect may in fact vary somewhat based on years in the U.S. Despite the fact that Mexican immigrants seem to arrive with a gradient that looks like that seen in the non-Hispanic white population, the overall effect of education for Mexican immigrants may be diluted somewhat over time, perhaps due to stressors associated with immigration and integration processes. The negative gradient among recent immigrants suggests that Mexico has a negative education gradient for binge drinking; however, it is also possible that those with more education who decide to immigrate to the U.S. are less likely to drink excessively than those who remain in Mexico. If this is the case, selection processes, rather than Mexican gradients for binge drinking, may be responsible for the gradients exhibited by recent immigrants.

Discussion

The research presented here sought to explain recent findings that the effect of education on health is weaker or even absent for numerous health-related variables in the Mexican American population in comparison to non-Hispanic whites (Goldman et al 2006). I investigated the hypothesis that these patterns are influenced by Mexican education gradients for health behaviors, which Mexican immigrants bring with them as they immigrate.

The study found evidence to support this notion for smoking and obesity. Later migrants (those who spent their childhood and adolescence in Mexico) exhibited a reverse gradient for smoking; they were *more* likely to smoke with each additional year of education. Early migrants (those who spent their childhood and adolescence in the U.S.) were *less* likely to smoke with each additional year of education. However, the effect of education on smoking did not differ by proximity to arrival. That is, the effect of education on smoking was about the same for those who had been in the U.S. for less than 5 years and those with longer residence. This second hypothesis, for reasons explained earlier, was assessed with a sample that included only those over age 30. Education gradients for smoking, as suggested by the first hypothesis concerning age at immigration, may be formed during adolescence; combined with the highly addictive nature of smoking, the effect of education may not change much based on years in the U.S. However, overall, these results suggest that the effect of education on smoking depends on age at immigration. This implies that Mexican gradients, operating through their influence on later migrants, may explain part of the weaker effect of education on smoking seen in Mexican immigrants and for the Mexican American population in general, relative to non-Hispanic whites (Goldman et al 2006).

Unlike smoking, the effect of education on overweight and obesity did not differ by age at immigration. However, it did differ by proximity to arrival in the U.S. This pattern is clearest for obesity. Education had a statistically significantly weaker effect on obesity for those closest to arrival (less than 5 years in the U.S.), in comparison to those in the U.S. for a longer period. Furthermore, results suggest that there is no effect of education on obesity for the recent immigrants—those with higher levels of education are just as likely to be obese as those with less education. The inconsistency of results between the two hypotheses may be due to

differences in the age ranges of the samples (the age at immigration sample included only those 30 and under). The effect of education on unhealthy weight may manifest itself more strongly after 30, even if education gradients linked to obesity (SES-graded habits and preferences around diet and exercise) are formed in adolescence. These effects may be picked up in the older sample, based on years in the U.S. In addition, the formative period for education gradients for overweight and obesity, unlike smoking, may not be restricted to adolescence; it may be extended to the 20s and even later, which would influence results more in an older sample. These data, as with smoking, point to the influence of Mexican education gradients, operating through proximity to arrival, on disparities in education effects for Mexican immigrants versus non-Hispanic whites for overweight and obesity (Goldman et al 2006).

The results for binge drinking were less clear than those for smoking and obesity. There was no statistically significant difference in the effect of education on the likelihood of binge drinking for early versus later migrants, and the effects were mixed for proximity to arrival. These results suggest that proximity to arrival and age at immigration are unlikely to explain the lack of education effect on binge drinking for Mexican Americans in comparison to non-Hispanic whites found in past research (Goldman et al 2006). Gradients for binge drinking may follow a different pattern than other health behaviors, in relation to U.S. and Mexican influences. The shape of these gradients may instead be determined by immigrant self-selection into the immigration process based on drinking behaviors and/or stressors associated with the immigration and integration process that change the shape of education-drinking gradients over time.

This paper attempted to explain an important recent finding, the absence of notable differentials for Mexican American adults for some health-related outcomes, in comparison to

non-Hispanic whites, and the fact that these weak gradients appear to be common among Mexican immigrants (Goldman et al 2006). While less socioeconomic disparity in health behaviors within the Mexican American population can signal less social inequality, such patterns do have significance for disparities between the Mexican American population and other groups in the long term, as education levels within the population increase. The findings presented here suggest that socioeconomic gradients in Mexico may be influencing these patterns for smoking and obesity among Mexican immigrants. Importantly, past research has found that gradients for the U.S.-born Mexican Americans were also sometimes weaker than those for non-Hispanic whites (Goldman et al 2006), suggesting that gradients may carry over at some level into the second generation. With this knowledge of social gradients, researchers and policymakers will be in a position to more accurately assess the role of socioeconomic improvements in healthier behaviors for the U.S. Mexican-origin population.

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Appendix

Table 1. Unweighted Descriptive Statistics: National Health Interview Survey, Mexican Immigrant Sample, 1998-2005.

	Age at immigration		Years in U.S.		
	15 and younger	16 and older	Less than 5 years	5 to 9 years	10 to 14 years
No.	1,152	3,406	746	1,016	1,481
Male (%)	44	51	50	41	45
Age, yrs, mean (SD)	24.0 (3.8)	25.4 (3.3)	40.2 (9.2)	39.4 (9.1)	38.8 (9.4)
Years of education, mean (SD)	12.4 (3.4)	9.5 (3.9)	8.3 (5.0)	8.5 (4.8)	9.0 (4.7)
Smoking (%)[a]	10	14	19	13	15
Binge drinking (%)[b]	7	9	9	8	8
Overweight/obese (%)[c]	55	52	65	66	71
Obese (%)[d]	16	14	18	24	25

[a] Smoking includes respondents who report they are current everyday smokers or current somedays smokers. Non-smokers includes never smokers and former smokers.
[b] Binge drinking defined as having 5 or more drinks on any day in the last week or month.
[c] Overweight/obese is defined as a body mass index of 25.0 kg/m^2 or higher.
[d] Obese is defined as a body mass index of 30.0 kg/m^2 or higher.

Table 2. Logistic Regression Coefficients for Smoking by Age at Immigration: National Health Interview Survey (NHIS: 1998-2005), Mexican Immigrants Aged 30 and under (N=4,075).[a]

	Logit	std. error	p
Male	1.790	0.082	0.000
Age	0.022	0.012	0.073
Education	-0.039	0.014	0.005
Later migrant	-0.127	0.007	0.000
Interaction:			
Later migrant x education	0.037	0.010	0.000
Constant	-18.398	0.189	0.000

Note: standard errors adjusted for clustering and stratification.
[a] Smoking includes respondents who report they are current everyday smokers or current somedays smokers. Non-smokers include never smokers and former smokers.

Table 3. Predicted Probability Distributions of Smoking by Age at Immigration: National Health Interview Survey (NHIS: 1998-2005), Mexican Immigrants Aged 30 and under.

	Age at immigration	
	15 and younger (early migrants)	16 and older (later migrants)
Completed 6th grade	.14	.15
High school graduate	.10	.16
College graduate	.08	.18

Table 4. Logistic Regression Coefficients for Smoking by Years in U.S.: National Health Interview Survey (NHIS: 1998-2005), Mexican Immigrants Aged 31 and Older (N=2,857).[a]

	Logit	std. error	p
Male	1.627	0.089	0.000
Age	0.001	0.006	0.890
Education	0.011	0 .024	0.648
Years in U.S. (ref: less than 5 years)			
5 to 9 years	0.004	0.536	0.994
10 to 14 years	-0.162	0.160	0.311
Interactions: Years in U.S. x education (ref: less than 5 years)			
5 to 9 years x education	-0.032	0.073	0.660
10 to 14 years x education	0.003	0.015	0.804
Constant	-20.22	0.451	0.000

Wald tests	X^2	d.f.	p
Set of years in U.S. categories	0.000	1	0.995
Set of years in U.S. x education interactions	0.190	1	0.660

Note: standard errors adjusted for clustering and stratification.
[a] Smoking includes respondents who report they are current everyday smokers or current somedays smokers. Non-smokers include never smokers and former smokers.

Table 5. Predicted Probability Distributions of Smoking by Years in U.S.: National Health Interview Survey (NHIS: 1998-2005), Mexican Immigrants Aged 31 and Older.

	Years in U.S.		
	Less than 5 years	5 to 9 years	10 to 14 years
Completed 6th grade	.20	.15	.16
High school graduate	.24	.15	.19
College graduate	.21	.13	.19

Table 6. Logistic Regression Coefficients for Overweight and Obese by Age at Immigration: National Health Interview Survey (NHIS: 1998-2005), Mexican Immigrants Aged 30 and under (N=3,873).[a]

	Logit	std. error	p
Male	0.440	0.040	0.000
Age	0.109	0.008	0.000
Education	-0.045	0.047	0.339
Later migrant	-0.531	0.671	0.428
Interaction:			
Later migrant x education	0.013	0.048	0.783
Constant	16.116	2.782	0.000

Note: standard errors adjusted for clustering and stratification.
[a] Overweight and obese is defined as a body mass index of 25.0 kg/m^2 or higher.

Table 7. Predicted Probability Distributions of Overweight and Obese by Age at Immigration: National Health Interview Survey (NHIS: 1998-2005), Mexican Immigrants Aged 30 and under.

	Age at immigration	
	15 and younger (early migrants)	16 and older (later migrants)
Completed 6th grade	.63	.55
High school graduate	.52	.47
College graduate	.49	.50

Table 8. Logistic Regression Coefficients for Overweight and Obese by Years in U.S.: National Health Interview Survey (NHIS: 1998-2005), Mexican Immigrants Aged 31 and Older (N=2,816).[a]

	Logit	std. error	p
Male	0.314	0.021	0.000
Age	0.009	0.003	0.006
Years of education	-0.020	0.006	0.000
Years in U.S. (ref: less than 5 years)			
5 to 9 years	0.243	0.063	0.000
10 to 14 years	0.545	0.026	0.000
Interactions: Years in U.S. x education (ref: less than 5 years)			
5 to 9 years x education	-0.021	0.023	0.374
10 to 14 years x education	-0.020	0.003	0.000
Constant	18.13	0.184	0.000

Wald tests	X^2	d.f.	p
Set of years in U.S. categories	14.64	1	0.000
Set of years in U.S. x education interactions	0.790	1	0.374

Note: standard errors adjusted for clustering and stratification.
[a] Overweight and obese is defined as a body mass index of 25.0 kg/m^2 or higher.

Table 9. Predicted Probability Distributions of Overweight by Years in U.S. and Years of Education: National Health Interview Survey (NHIS: 1998-2005), Mexican Immigrants Aged 31 and Older.

	Years in U.S.		
	Less than 5 years	5 to 9 years	10 to 14 years
Completed 6th grade	.67	.67	.73
High school graduate	.65	.60	.66
College graduate	.57	.56	.64

Table 10. Logistic Regression Coefficients for Obese by Years in U.S.: National Health Interview Survey (NHIS: 1998-2005), Mexican Immigrants Aged 31 and Older (N=2,774).[a]

	Logit	std. error	p
Male	-0.355	0.043	0.000
Age	0.009	0.005	0.093
Years of education	-0.005	0.001	0.000
Years in U.S. (ref: less than 5 years)			
5 to 9 years	0.377	0.017	0.000
10 to 14 years	0.815	0.149	0.000
Interactions: Years in U.S. x education (ref: less than 5 years)			
5 to 9 years x education	-0.007	0.003	0.024
10 to 14 years x education	-0.048	0.088	0.000
Constant	-18.725	.248	0.000

Wald tests	X^2	d.f.	p
Set of years in U.S. categories	29.95	1	0.000
Set of years in U.S. x education interactions	30.16	1	0.000

Note: standard errors adjusted for clustering and stratification.
[a] Obese is defined as a body mass index of 30.0 kg/m^2 or higher.

Table 11. Predicted Probability Distributions for Obese by Years in U.S. : National Health Interview Survey (NHIS: 1998-2005), Mexican Immigrants Aged 31 and Older.

	Years in in U.S.		
	Less than 5 years	5 to 9 years	10 to 14 years
Completed 6th grade	.20	.26	.29
High school graduate	.20	.25	.21
College graduate	.20	.22	.19

Table 12. Logistic Regression Coefficients for Binge Drinking by Age at Immigration: National Health Interview Survey (NHIS: 1998-2005), Mexican Immigrants Aged 30 and under (N=3,643).[a]

	Logit	std. error	p
Male	3.618	0.200	0.000
Age	0.021	0.015	0.158
Education	0.011	0.079	0.885
Later migrant	0.699	0.446	0.118
Interaction:			
Later migrant x education	-0.060	0.055	0.277
Constant	-18.960	1.218	0.000

Note: standard errors adjusted for clustering and stratification.
[a] Binge drinking defined as having 5 or more drinks on any day in the last week or month.

Table 13. Predicted Probability Distributions of Binge Drinking by Age at Immigration: National Health Interview Survey (NHIS: 1998-2005), Mexican Immigrants Aged 30 and under.

	Age at immigration	
	15 and younger (early migrants)	16 and older (later migrants)
Completed 6th grade	.09	.13
High school graduate	.09	.09
College graduate	.07	.09

Table 14. Logistic Regression Coefficients for Binge Drinking by Years in U.S.: National Health Interview Survey (NHIS: 1998-2005), Mexican Immigrants Aged 31 and Older (N=2,520).[a]

	Logit	std. error	p
Male	2.923	0.395	0.000
Age	-0.064	0.007	0.000
Education	-0.070	0.008	0.000
Years in U.S. (ref: less than 5 years)			
5 to 9 years	-0.732	0.236	0.002
10 to 14 years	-0.293	0.579	0.614
Interactions:			
Years in U.S. x education (ref: less than 5 years)			
5 to 9 years x education	0.082	0.028	0.004
10 to 14 years x education	0.036	0.033	0.263
Constant	-19.09	0.845	0.000

Wald tests	X^2	d.f.	p
Set of years in U.S. categories	0.250	1	0.614
Set of years in U.S. x education interactions	1.25	1	0.263

Note: standard errors adjusted for clustering and stratification.
[a] Binge drinking defined as having 5 or more drinks on any day in the last week or month.

Table 15. Predicted Probability Distributions for Binge Drinking by Years in U.S.: National Health Interview Survey (NHIS: 1998-2005), Mexican Immigrants Aged 31 and Older.

	Years in U.S.		
	Less than 5 years	5 to 9 years	10 to 14 years
Completed 6th grade	.11	.08	.10
High school graduate	.10	.14	.11
College graduate	.04	.12	.07