TITLE: Education gradients in smoking and leisure-time physical inactivity among Hispanic and Asian young adults

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ABSTRACT

*Objectives***:** We assess whether associations between education and two health behaviors, smoking and leisure-time physical inactivity (LTPI), depend on nativity and age at immigration among Hispanic and Asian young adults.

*Methods***:** Data come from the 2000-2008 National Health Interview Survey. The sample included 13345 Hispanics and 2528 Asians aged 18 to 30. Smoking and LTPI were based on self reports. We used logistic regression to examine education differentials in these behaviors by nativity and age at immigration.

*Results***:** Associations between education and both smoking and LTPI are weaker for foreign-born versus US-born Hispanic young adults but do not vary by nativity for Asians. Education associations for smoking and LTPI among Hispanic young adults who immigrated at an early age more closely resemble those of the US-born than do associations among individuals who immigrated at an older age. A similar pattern is evident for Asians for smoking.

*Conclusions***:** Health promotion efforts aimed at reducing disparities in key health behaviors among Hispanic and Asian young adults should take into account country of residence in childhood and adolescence as well as nativity.

A wide literature has established the existence of a "social gradient" in health, whereby health improves with each increment in socioeconomic status (SES).[1-2] Although most health outcomes show social gradients, research has increasingly suggested that SES may not have the same effect on health for all US populations.[3-6] In particular, researchers have found more modest socioeconomic differentials in health outcomes and related health behaviors for foreign-born than corresponding US-born populations.[4-5, 7]

One explanation for this pattern sees weaker social gradients in health and health behaviors among the foreign-born as rooted in lifestyle-related norms and practices in sending countries, which may continue to shape outcomes along socioeconomic lines after immigration.[4] This study extends the research in this area by assessing whether the relationship between education and some health behaviors depends not only on nativity but also on country of residence during childhood and adolescence. Although a recent study found that the association between subjective social status and mood dysfunction among Asian immigrants varied by age at immigration,[6] no research to our knowledge has examined patterns for objective measures of SES and health behaviors. In addition to enhancing understanding of differences in social gradients in health behaviors in US populations, results from this analysis may inform efforts to better target interventions to groups at higher risk for unhealthy practices.

Our conceptual framework is informed by several areas of research. An extensive literature suggests that some health behaviors, like smoking, are heavily influenced by early-life experiences.[8-10] In addition, disparities in some health behaviors begin to form in childhood and adolescence, both in and outside the US.[10-13] Mechanisms that shape health behaviors by SES—access to and affordability of unhealthy lifestyles, norms and sanctions surrounding particular practices, etc.—may operate in distinct ways in the US versus some sending countries for immigration. Finally, research on acculturation suggests that health behaviors shift as immigrants

enter new contexts towards patterns observed among the US-born, a process which may be especially influential in childhood and adolescence.[14-17] While these changes may affect immigrants across the socioeconomic spectrum, they may also vary by SES if young immigrants adopt the health behaviors of US-born youth with similar socioeconomic backgrounds.

This analysis focuses on education gradients in smoking and leisure-time physical inactivity (LTPI). Identifying consistencies in the influence of education, nativity, and age at immigration across health behaviors may inform a more comprehensive approach to addressing disparities. We selected these behaviors for study given their associations with education and nativity and because both are shaped in part by mechanisms operating in childhood and adolescence.[11, 18-20] Additionally, smoking and physical inactivity, along with poor diet, are among the leading causes of death in the US.[21] [1] We examine patterns for education, rather than income or occupational status, because it may better represent SES for individuals who do not work consistently in the paid workforce, which is particularly relevant for immigrant populations.[5, 22-23] We focus on young adults (aged 18 to 30), due in part to limitations on data available to determine age at immigration (explained in detail below). However, understanding patterns in young adulthood may provide insights into those for related health outcomes in older populations.

We first determine whether previous findings of differences in education gradients in smoking and LTPI by nativity are evident by young adulthood.[4-5] If education gradients in smoking and LTPI are influenced by exposures in early life, then variation by nativity and age at immigration should be evident by young adulthood. Second and more importantly, we investigate whether associations between education and both smoking and LTPI among young adults who immigrated in childhood or adolescence more closely resemble those of the US-born

[1] We did not consider diet due to lack of available data in the data source utilized for this analysis.

than is the case for those who immigrated after these periods. We focus on Hispanics and Asians given that these groups include large immigrant populations. Finally, we assess whether patterns are similar for Hispanic and Asian subgroups and by gender.

METHODS

Data source

Data are from the National Health Interview Survey (NHIS), a nationally-representative, survey of the US civilian, non-institutionalized population conducted annually. The survey follows a stratified, multistage probability design.[24] We combined data from 2000 to 2008 to generate a sample size sufficient to accommodate education interactions with nativity, age at immigration, and subgroup or gender. One adult was randomly selected for interview from sampled families. Response rates among eligible adults ranged from 74% to 88%. All information was self-reported.

The sample included 13345 Hispanics (6295 US-born and 7050 foreign-born) and 2528 Asians (739 US-born and 1789 foreign-born) aged 18 to 30. Hispanic subgroups included Mexicans, Central/South Americans, Puerto Ricans, and Other/Multiple Hispanic. Asian subgroups included Asian Indians, Chinese, Filipinos, and Other/Multiple Asians. Sample sizes for subgroups are listed in Table 1. Individuals missing information on study variables were excluded (less than 3% for any variable).

Variables

Smoking was defined as current versus never or former smoking. Leisure-time physical inactivity was defined as no activity versus any moderate or vigorous activity per week.

Independent variables included education (in years), Hispanic or Asian race/ethnicity and subgroup, nativity (born in the US versus other countries/US territories), age at immigration, gender, and age (in years).

To test the hypothesis concerning both nativity and age at immigration, the variable for nativity was recoded into three categories: US-born, immigration at or before age 15, and immigration after age 15. Age 15 was selected as the cutpoint to ensure that individuals classified in the younger immigration category would have a few years of exposure to the US environment before adulthood. Immigrants were classified into one of the two age-at-immigration groups based on age at interview minus years of US residence. The NHIS provides data on years of US residence in intervals (<1 year, 1 to <5 years, 5 to <10 years, 10 to <15 years, and 15+ years). We approximated years of residence by calculating the mean for each interval and rounding up.

Because data on exact years of residence was unavailable, there was some potential for misclassification. For example, a 22 year-old who had been in the US for 5 to <10 years could have immigrated at any age from 13 to 17. Because all individuals in this interval were assigned to 8 years of residence, all 22 year-olds in this interval were coded as immigrating at age 14. Those who actually immigrated at ages 16 or 17 would have been misclassified in the younger age-at-immigration group (at or before age 15). However, 22 year-olds in all other intervals were correctly classified (i.e., those resident for <1 year or 1 to <5 years were correctly classified as immigrating after age 15 and those resident for 10 to <15 years or 15+ years were correctly classified as immigrating at or before age 15). Under the assumption that actual number of years of residence is evenly distributed within each interval, we estimate that the proportion misclassified was 7% among Hispanic immigrants (4% of the full Hispanic sample, including the US-born) and 4% among Asian immigrants (3% of the full Asian sample). We conducted a sensitivity analysis by removing all potentially misclassified individuals from each sample and report results in the next section.

Analysis

A series of logistic regression models were estimated for each outcome separately for Hispanics and Asians. We tested the first hypothesis by interacting education and nativity (Model 1). In Model 2, we included an interaction term for education and the three-category nativity/age at immigration variable described above. Finally, we determined whether patterns varied by subgroup or gender by including a three-way interaction term (e.g., educationXnativity/age at immigrationXsubgroup) (Model 3, not shown).[2] Statistical significance of sets of interaction terms were assessed through adjusted Wald tests. Differences in education gradients between the two age-at-immigration categories (Model 2) were assessed via a postestimation test. All analyses were conducted in Stata 11.0 using survey estimation commands to account for the complex sampling design of the NHIS.[25]

RESULTS

Characteristics of Hispanic and Asian young adults are provided in Table 1 by nativity and age at immigration. Hispanics have less education on average than Asians in each category. Mexicans are the largest Hispanic subgroup in all categories, but among Asians no single group predominates.

For both Hispanics and Asians, smoking prevalence is higher among the US-born than foreign-born whereas the reverse is true for LTPI. Among Asian immigrants, those who arrived at or before age 15 are more likely to smoke than those who immigrated after age 15. The opposite pattern is evident for Hispanics, although the difference between age-at-immigration groups is not significant. LTPI is more common among individuals with older versus younger

[2] Although interactions by subgroup or gender were not significant (see next section), we stratified preliminary analyses by these variables. Because results did not add substantively to findings, we elected not to stratify analyses by either variable.

age at immigration for both Hispanics and Asians. All differences, with the noted exception, are statistically significant ($p<0.05$).

Results from logistic regressions of smoking and LTPI for Hispanics and Asians are presented in Tables 2 and 3, respectively. Our first hypothesis posited that education gradients in both outcomes are weaker for foreign-born versus US-born populations. This hypothesis is confirmed for Hispanics, based on the significance of the odds ratios for the educationXnativity interaction terms for both smoking and LTPI (Model 1). Because the odds ratios for educationXnativity are greater than 1.00 (and statistically significant), this indicates that for each additional year of education, foreign-born Hispanics have less decrease in the odds of smoking and LTPI (i.e., a weaker gradient) than do the US-born (the reference). Education associations do not vary by nativity for Asians for either behavior (Model 1, Table 3). There are no significant differences in these patterns by subgroup or gender for Hispanics or Asians (i.e., three-way interactions for educationXnativityXsubgroup or gender were not significant; data not shown).

Our second hypothesis predicted differences in education gradients for the two outcomes by both nativity and age at immigration. We evaluated this hypothesis by testing the two individual interaction terms shown in Model 2 as a set, via adjusted Wald tests. These tests (data not shown) support this hypothesis for smoking for both populations (F= 13.03, p=0.000 for Hispanics; F=8.14, p=0.000 for Asians) and for LTPI for Hispanics (F=15.41, p=0.000). For Hispanics, the statistical significance of the individual interaction term in Model 2 for the younger age-at-immigration group (educationXimmigrated at/before age15) indicates that for each additional year of education, this group exhibits less decrease in the odds of either behavior than the US-born (the reference). The same is true for those who immigrated after age 15 (educationXimmigrated after age 15). A postestimation test (data not shown) suggests that there is also a significant difference in the interaction terms for the two age-at-immigration groups

($p<0.01$ for either outcome). Among Asians, significant differences are evident for smoking only for the group that immigrated after age 15 relative to the US-born (Model 2). The difference between the terms for the two age-at-immigration groups is also statistically significant ($p=0.000$; data not shown). There are no significant differences in these patterns by subgroup or gender for Hispanics or Asians (data not shown).

To illustrate these relationships, we graph significant interactions from Model 2 in Figure 1. The graphs are based on predicted probabilities; since these require specifying a value for each variable in the model, they are depicted for specific subgroups. The particular group selected is not important—given that three-way interactions were not significant, the slopes of the lines in the figure would be the same for any subgroup (or either gender). We graph associations for Mexicans and Asian Indians because they are among the largest subgroups in each population. Patterns are graphed for males aged 25 from each group. We graph associations from 6 to 16 years of education for Mexicans and for 9 to 20 years of education for Asian Indians to avoid emphasizing patterns at education levels uncommon to each population.

In the Mexican male population, the steepest education-smoking gradient is evident in US-born. In the Mexican population that immigrated at a younger age, a shallower, but still inverse, gradient is evident. The Asian Indian population that immigrated at a younger age exhibits an inverse gradient very similar to that of the US-born. Populations that immigrated after age l5 in both groups show a slightly positive gradient. For LTPI among Mexicans, the steepest inverse gradient is seen in the US-born population and the shallowest in the population immigrating after age 15, with the population immigrating at or before age 15 falling in between.

The figure suggests that there are distinctions in patterns for smoking versus LTPI. The probability of smoking is similar among more educated individuals of Mexican-origin, regardless of nativity or age at immigration. However, among the US-born, this probability is sharply

higher among the less educated, relative to both age-at-immigration groups. (A similar, although less pronounced, pattern is apparent for Asian Indians with less education who are either US-born or who immigrated at or before age 15, relative to those who immigrated after age 15). For LTPI, in contrast, greater differences between the three Mexican-origin groups are seen among the more (versus less) educated.

To examine potential bias associated with misclassification of immigrants into the two age-at-immigration groups, we excluded all individuals who could have been misclassified from analysis. Results (not shown) were identical to those for the full sample, with the exception that there was no significant difference in education-smoking associations for US-born Hispanics versus those who immigrated at or before age 15 (p=0.20).

DISCUSSION

Education differentials are smaller for smoking and LTPI for foreign-born versus US-born Hispanic young adults, but are similar for both behaviors regardless of nativity for Asians. Among Hispanic populations, education gradients for both smoking and LTPI are affected not only by nativity but also by age at immigration among the foreign-born. The gradient of the young adult population that immigrated during childhood or adolescence more closely resembles that of the US-born population than does the gradient of the population that resided in sending countries during these periods. Although there was no overall influence of nativity on the education gradient for either behavior in the Asian young adult population, the population that immigrated at older ages showed a weak positive education gradient for smoking while that of the population that immigrated in childhood or adolescence was statistically similar to the inverse gradient of the US-born population. These findings support the hypothesis that developmental contexts in the US and sending countries differentially shape the relationship between education and some health behaviors in young adulthood.

Results provide guidance for future research aimed at identifying the mechanisms that lie beneath observed patterns, and for targeting groups most at-risk for smoking and LTPI. Somewhat different mechanisms may underlie variation in education gradients for smoking versus LTPI. The likelihood of smoking is higher among the *least* educated US-born Hispanics, and, to a lesser extent, for both US-born Asians and Asians who immigrated at or before age 15. There is less difference in the likelihood of smoking among the most educated individuals, regardless of nativity or age at immigration. Thus, mechanisms operating at the *lower* end of the socioeconomic spectrum may be particularly important to understanding the degree to which exposure to different early-life environments generates smoking disparities in young adulthood. These mechanisms may include greater normative acceptability of smoking and/or contextual differences in social determinants such as stress or discrimination during early life in lower socioeconomic strata in the US versus sending countries.[6] Economic factors, such as differences in the affordability of cigarettes among lower SES adolescents in the US versus sending countries, may also be important. Findings further suggest that smoking interventions be targeted toward less educated Hispanics and Asians with early-life exposure to the US environment, particularly the US-born in both groups, as well as foreign-born Asians.

For LTPI among Hispanics, differences in education gradients by nativity/age at immigration appear to be driven by *more* (rather than less) educated populations. Thus, mechanisms operating at the *higher* end of the socioeconomic spectrum may be particularly important to understanding observed patterns. For example, norms sanctioning inactivity in higher socioeconomic strata, which may be absorbed fairly early in life, may be more developed in the US than in parts of Latin America and the Caribbean. Unlike smoking, findings suggest that efforts to decrease disparities in LTPI among Hispanics need not target particular nativity or age-at-immigration groups, but rather all young adults with lower education levels.

While findings are consistent with hypotheses surrounding developmental contexts, we were unable to rule out alternative explanations. Health selection associated with immigration to the US may be more pronounced among lower SES immigrants;[4] however, prior research found little evidence of health selection relative to education-smoking gradients in the Mexican immigrant population.[7] Although there has been no similar study concerning exercise, the patterns observed here for LTPI among Hispanics are inconsistent with socioeconomically-determined health selection. Differences in education-LTPI associations by nativity/age at immigration are largely apparent among more educated Hispanics. There is little reason to expect that, among more educated Hispanics, physically-inactive individuals would be *more* likely to immigrate than the physically active, given physical demands of transit and settlement in the US.

A second alternative explanation for differences in education-LTPI gradients among Hispanics concerns labor market issues. More educated Hispanic immigrants may have to work longer hours than the US-born, due to lower labor market access, leaving less time for discretionary physical activity.[26] However, a sensitivity analysis (not shown) among working young adults found comparable results for LTPI, controlling for the number of hours worked in the last week, with the exception that education associations were similar for those who immigrated at young ages versus the US-born.

Although prior research has found differences in education gradients in physical activity by nativity among Asians,[5] we found no variation in the relationship between education and LTPI among Asians by either nativity or age at immigration. Since our study was limited to young adults, findings may indicate a cohort effect. Given that variation in education-smoking gradients is evident by nativity/age at immigration among Asians, additional investigation may clarify why LTPI does not follow a similar pattern.

Available data supported examination only of leisure-time rather than non-leisure time inactivity.[27] LTPI may have less health relevance for less educated young adults, given greater likelihood of employment in occupations requiring physical exertion than more educated adults. In analysis not reported, we found that the association between LTPI and obesity was similar for Hispanic young adults in manual versus non-manual occupations (*p* for interaction=0.13). Additionally, obesity prevalence was equally high (~20%) among Hispanic young adults regardless of occupation, indicating that working in manual occupations alone is insufficient for obesity prevention. These findings suggest that leisure-time physical activity may represent a health resource for Hispanic young adults regardless of SES.

Importantly, education quality and economic returns to education may differ for those educated in and outside the US, which may have affected results.[28-31] If poorer quality education in sending countries was behind observed patterns, rather than the social mechanisms discussed above, we would expect greater probability of smoking and LTPI in young adults in the two age-at-immigration groups across the educational spectrum, which was not the case. Lower economic returns to education in the US for Hispanic and Asian young adult immigrants might explain the lower probability of smoking of those with less education, given less disposable income with which to purchase cigarettes.[32] However, this explanation seems unlikely given that similar patterns were not observed for LTPI, which is also likely to depend to some extent on financial resources.[33-34]

This analysis was subject to limitations in addition to those noted earlier. Lack of available data precluded investigation of family, peer, and neighborhood mechanisms that may underlie observed patterns. An understanding of these mechanisms would provide additional information to target interventions. Smoking status in particular may be differentially reported by education, nativity, or age at immigration among Hispanics and Asians, which may have

influenced results.[35-38] Also, the threshold of age 15 for immigration during formative periods was chosen somewhat arbitrarily. However, findings (not shown) were substantively similar when age at immigration was dichotomized at age 12, pointing to the importance of exposure to the US context in general during formative phases.

Despite these limitations, this paper makes important contributions to our understanding of social gradients in health behaviors. Results suggest that not only nativity but also early-life contexts may be crucial to understanding how gradients in health behaviors are differentially shaped in diverse populations. Although previous research has made substantial progress in identifying mechanisms between socioeconomic disadvantage and health behaviors, this analysis suggests that there is a need to consider unique early-life pathways for immigrant populations, relative to the US-born, based on age at immigration. Such research may further inform efforts to reduce disparities in Hispanic and Asian populations and hold broader lessons concerning the origins of social gradients in health and health behaviors in high-income countries.

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REFERENCES

1. Goldman N. Social inequalities in health. Disentangling the underlying mechanisms. *Ann N Y Acad Sci* 2001;954(1):118-139.
2. Adler NE, Boyce T, Chesney MA, et al. Socioeconomic status and health. The challenge of the gradient. *Am Psychol* 1994;49(1):15-24.
3. Sanchez-Vaznaugh EV, Kawachi I, Subramanian SV, Sánchez BN, Acevedo-Garcia D. Differential effect of birthplace and length of residence on body mass index (BMI) by education, gender and race/ethnicity. *Soc Sci Med* 2008;67(8):1300-1310.
4. Goldman N, Kimbro RT, Turra CM, Pebley AR. Socioeconomic gradients in health for white and Mexican-origin populations. *Am J Public Health* 2006;96(12):2186-93.
5. Kimbro RT, Bzostek S, Goldman N, Rodriguez G. Race, ethnicity, and the education gradient in health. *Health Aff (Millwood)* 2008;27(2):361-72.
6. Leu J, Yen IH, Gansky SA, Walton E, Adler NE, Takeuchi DT. The association between subjective social status and mental health among Asian immigrants: investigating the influence of age at immigration. *Soc Sci Med* 2008;66(5):1152-1164.
7. Buttenheim A, Goldman N, Pebley A, Wong R, Chung C. Do Mexican immigrants "import" social gradients in health behaviors to the US? *Soc Sci Med* (forthcoming).
8. Williams SS, Mulhall PF. Where public school students in Illinois get cigarettes and alcohol: characteristics of minors who use different sources. *Prev Sci* 2005;6(1):47-57.
9. Birch LL. Development of food preferences. *Annual Rev Nutr* 1999;19(1):41-62.
10. Gilman SE, Abrams DB, Buka SL. Socioeconomic status over the life course and stages of cigarette use: initiation, regular use, and cessation. *J Epidemiol Comm Health* 2003;57(10):802-8.

11. Gordon-Larsen P, McMurray RG, Popkin BM. Determinants of adolescent physical activity and inactivity patterns. *Pediatrics* 2000;105(6):e83.

12. Vázquez-Segovia LA, Sesma-Vázquez S, Hernandez-Avila M. El consumo de tabaco en los hogares en México: Resultados de la Encuesta de Ingresos y Gastos de los Hogares, 1984-2000 [Smoking in Mexican households: Findings from the Encuesta de Ingresos y Gastos de los Hogares, 1984-2000]. *Salud Publica Mex* 2002;44(supl I):S76-S81.

13. Caballero R, Madrigal L, Hidalgo S. El consumo de tabaco, alcohol y otras drogas ilegale, en los adolecentes de diferentes estratos socioeconomicos de Guadalajara [Smoking, drinking and use of illicit drugs among adolescents from different social groups in Guadalajara]. *Salud Mental* 1999;22:1-8.

14. Abraido-Lanza AF, Chao MT, Florez KR. Do healthy behaviors decline with greater acculturation? Implications for the Latino mortality paradox. *Soc Sci Med* 2005;61(6):1243-55.

15. Lara M, Gamboa C, Kahramanian MI, Morales LS, Bautista DE. Acculturation and Latino health in the United States: a review of the literature and its sociopolitical context. *Annual Rev Pub Health* 2005;26:367-97.

16. Unger JB, Cruz TB, Rohrbach LA, et al. English language use as a risk factor for smoking initiation among Hispanic and Asian American adolescents: Evidence for mediation by tobacco-related beliefs and social norms. *Health Psychol* 2000;19(5):403-10.

17. Unger JB, Reynolds K, Shakib S, Spruijt-Metz D, Sun P, Johnson CA. Acculturation, physical activity, and fast-food consumption among Asian-American and Hispanic adolescents. *J Community Health* 2004;29(6):467-81.

18. Sallis J, Prochaska J, Taylor W. A review of correlates of physical activity of children and adolescents. *Med Sci Sports Exerc* 2000;32(5):963-975.

19. Van der Horst K, Paw M, Twisk J, Van Mechelen W. A brief review on correlates of physical activity and sedentariness in youth. *Med Sci Sports Exerc* 2007;39(8):1241-1250.

20. Dowda M, Ainsworth BE, Addy CL, Saunders R, Riner W. Correlates of physical activity among U.S. young adults, 18 to 30 years of age, from NHANES III. *Ann Behav Med* 2003;26(1):15-23.

21. Mokdad AH, Marks JS, Stroup DF, Gerberding JL. Actual causes of death in the United States, 2000. *JAMA* 2004;291(10):1238-45.

22. Passel J. The size and characteristics of the unauthorized migrant population in the US: estimates based on the March 2005 Current Population Survey. Washington, DC: Pew Hispanic Center; 2006.

23. Capps R. A profile of the low-wage immigrant workforce. Washington, DC: Urban Institute; 2003.

24. Botman S, Moore T, Moriarity C, Parsons V. Design and estimation for the National Health Interview Survey, 1995-2004. *Vital Health Stat 2* 2000(130):1-31.

25. StataCorp. Stata Statistical Software. Release 11.0. College Station, TX: Stata Corporation; 2009.

26. Warren R. Estimates of the unauthorized immigrant population residing in the United States: 1990 to 2000. Washington, DC: Office of Policy and Planning, U.S. Immigration and Naturalization Service; 2003.

27. Kandula NR, Lauderdale DS. Leisure time, non-leisure time, and occupational physical activity in Asian Americans. *Ann Epidemiol* 2005;15(4):257-265.

28. Ferrer A, Riddell WC. Education, credentials, and immigrant earnings. *Can J Econ* 2008;41(1):186-216.

29. Jasso G, Rosenzweig M, Smith J. The earnings of U.S. immigrants: world skill prices, skill transferability, and selectivity. Unpublished manuscript. Available at http://129.3.20.41/eps/lab/papers/0312/0312007.pdf.

30. Catanzarite L. Brown-collar jobs: occupational segregation and earnings of recent-immigrant Latinos. *Sociol Perspect* 2000;43(1):45-75.

31. Lee J, Barro R. Schooling quality in a cross-section of countries. *Economica* 2001;68(272):465-488.

32. Roeseler A, Burns D. The quarter that changed the world. *Tob Control* 2010;19 Suppl 1:i3-15.

33. Adler NE, Newman K. Socioeconomic disparities in health: pathways and policies. *Health Aff* 2002;21(2):60-76.

34. Diez Roux AV, Evenson KR, McGinn AP, et al. Availability of recreational resources and physical activity in adults. *Am J Public Health* 2007;97(3):493-9.

35. Wewers ME, Dhatt RK, Moeschberger ML, Guthrie RM, Kuun P, Chen MS. Misclassification of smoking status among Southeast Asian adult immigrants. *Am J Respir Crit Care Med* 1995;152(6 Pt 1):1917-21.

36. Fisher MA, Taylor GW, Shelton BJ, Debanne S. Age and race/ethnicity-gender predictors of denying smoking, United States. *J Health Care Poor Underserved* 2008;19(1):75-89.

37. Fisher M, Taylor G, Shelton B, Debanne S. Sociodemographic characteristics and diabetes predict invalid self-reported non-smoking in a population-based study of U.S. adults. *BMC Public Health* 2007;7(1):33.

38. Wills TA, Cleary SD. The validity of self-reports of smoking: analyses by race/ethnicity in a school sample of urban adolescents. *Am J Public Health* 1997;87(1):56-61.

Table 1. Characteristics of Hispanics and Asians aged 18 to 30, National Health Interview Survey 2000-2008 (N=15873)[a]

	Hispanics				Asians			
		Foreign-born				Foreign-born		
	US-born	All	Immigrated at/before age 15	Immigrated after age 15	US-born	All	Immigrated at/before age 15	Immigrated after age 15
No.(unweighted)	6295	7050	2918	4132	739	1789	705	1084
Sociodemographic characteristics								
Age, mean (SE), years	24 (.07)	25 (.05)	24 (.09)	26 (.06)	23 (.18)	25 (.12)	24 (.19)	26 (.13)
Male, % (n)	50 (2676)	55 (3428)	54 (1323)	55 (2105)	53 (377)	50 (891)	53 (340)	48 (551)
Education, mean (SE), years	12 (.03)	10 (.06)	11 (.08)	10 (.08)	14 (.10)	14 (.10)	14 (.11)	15 (.14)
Hispanic ethnicity, % (n)								
Mexican	70 (4358)	68 (4756)	66 (1877)	70 (2879)	--	--	--	--
Central/South Am.	7 (384)	22 (1495)	21 (595)	23 (900)	--	--	--	--
Puerto Rican	12 (805)	5 (380)	7 (231)	3 (149)	--	--	--	--
Other/Multiple[b]	11 (748)	5 (419)	7 (215)	4 (204)	--	--	--	--
Asian ethnicity, % (n)								
Asian Indian	--	--	--	--	13 (106)	30 (552)	15 (104)	42 (448)
Chinese	--	--	--	--	19 (148)	17 (325)	15 (125)	18 (200)
Filipino	--	--	--	--	29 (210)	15 (235)	18 (124)	13 (111)
Other/Multiple[c]	--	--	--	--	39 (275)	39 (677)	52 (352)	27 (325)
Health behaviors								
Smoking, % (n)	20 (1324)	12 (893)	11 (341)	13 (552)	18 (138)	13 (261)	15 (112)	12 (149)
Leisure-time physical inactivity, % (n)	36 (2415)	53 (3870)	47 (1437)	58 (2433)	22 (152)	34 (578)	30 (189)	37 (389)

[a] Characteristics are weighted using weights provided by the National Health Interview Survey. Percentages may not sum to 100 due to rounding error.

[b] Other/multiple Hispanic category includes Cuban, Dominican, multiple Hispanic, other Latin American, and other Spanish subgroups.

[c] Other/multiple Asian category includes Korean, Vietnamese, Japanese, and other/multiple Asian subgroups.

Table 2. Odds ratios from logistic regression models for smoking and leisure-time physical inactivity, Hispanics aged 18 to 30, National Health Interview Survey 2000-2008 (N=13345)

	Smoking		Leisure-time physical inactivity	
	Model 1	Model 1	Model 1	Model 1
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Age	1.03 (1.02, 1.05)	1.03 (1.01, 1.05)	1.01 (1.00, 1.03)	1.01 (0.99, 1.02)
Male	2.49 (2.19, 2.84)	2.49 (2.19, 2.84)	0.67 (0.61, 0.73)	0.67 (0.61, 0.73)
Education	0.87 (0.83, 0.90)	0.87 (0.83, 0.91)	0.80 (0.77, 0.83)	0.80 (0.77, 0.84)
Nativity (ref: US-born)	0.12 (0.07, 0.22)		0.51 (0.30, 0.87)	
Nativity/age at immigration (ref: US-born)				
Immigrated at/before age 15		0.19 (0.09, 0.37)		0.63 (0.34, 1.18)
Immigrated after age 15		0.10 (0.05, 0.19)		0.46 (0.27, 0.79)
Hispanic subgroup (ref: Mexican)				
Central/South American	1.13 (0.93, 1.39)	1.12 (0.92, 1.37)	0.84 (0.73, 0.97)	0.83 (0.72, 0.96)
Puerto Rican	1.95 (1.59, 2.40)	1.97 (1.60, 2.43)	1.05 (0.90, 1.23)	1.07 (0.91, 1.25)
Other/Multiple Hispanic	1.89 (1.54, 2.31)	1.89 (1.54, 2.31)	1.33 (1.13, 1.57)	1.34 (1.14, 1.58)
NativityXeducation				
(ref: US-bornXeducation)	1.13 (1.07, 1.18)		1.10 (1.05, 1.15)	
Nativity/age at immigrationXeducation				
(ref: US-bornXeducation)				
Immigrated at/before age 15				
Xeducation		1.08 (1.02, 1.14)		1.07 (1.01, 1.12)
Immigrated after age 15Xeducation		1.16 (1.10, 1.23)		1.13 (1.08, 1.18)

Note: OR=odds ratio, CI=confidence interval

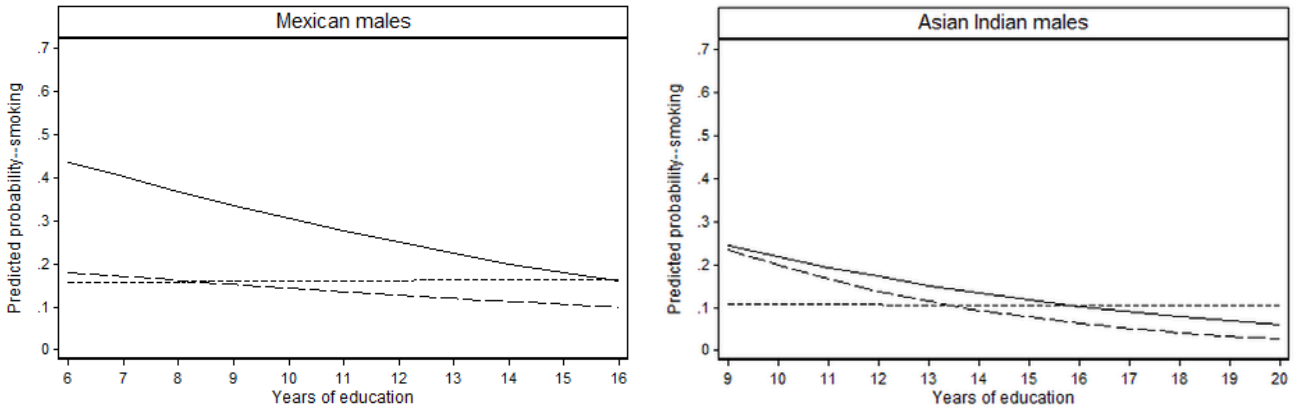
Table 3. Odds ratios from logistic regression models for smoking and leisure-time physical inactivity, Asians aged 18 to 30, National Health Interview Survey 2000-2008 (N=2528)

	Smoking		Leisure-time physical inactivity	
	Model 1	Model 1	Model 1	Model 1
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Age	1.06 (1.01, 1.11)	1.07 (1.02, 1.12)	1.01 (1.01, 1.08)	1.03 (0.99, 1.07)
Male	2.48 (1.94, 3.18)	2.54 (1.97, 3.26)	0.66 (0.52, 0.84)	0.67 (0.52, 0.85)
Education	0.87 (0.76, 0.98)	0.86 (0.76, 0.98)	0.88 (0.80, 0.97)	0.89 (0.81, 0.99)
Nativity (ref: US-born)	0.31 (0.05, 2.11)		3.21 (0.75, 13.77)	
Nativity/age at immigration (ref: US-born)				
Immigrated at/before age 15		1.79 (0.20, 16.24)		6.51 (1.19, 35.56)
Immigrated after age 15		0.10 (0.01, 0.83)		4.41 (0.88, 22.04)
Asian subgroup (ref: Asian Indian)				
Chinese	0.97 (0.60, 1.58)	1.06 (0.65, 1.72)	0.92 (0.65, 1.29)	1.01 (0.71, 1.44)
Filipino	2.59 (1.65, 4.04)	2.82 (1.78, 4.45)	0.89 (0.63, 1.25)	1.01 (0.71, 1.44)
Other/Multiple Asian	2.42 (1.63, 3.58)	2.69 (1.79, 4.05)	0.90 (0.66, 1.20)	1.03 (0.75, 1.41)
NativityXeducation				
(ref: US-bornXeducation)	1.07 (0.94, 1.22)		0.96 (0.87, 1.06)	
Nativity/age at immigrationXeducation				
(ref: US-bornXeducation)				
Immigrated at/before age 15				
Xeducation		0.93 (0.80, 1.09)		0.90 (0.79, 1.01)
Immigrated after age 15Xeducation		1.16 (1.01, 1.33)		0.96 (0.86, 1.07)

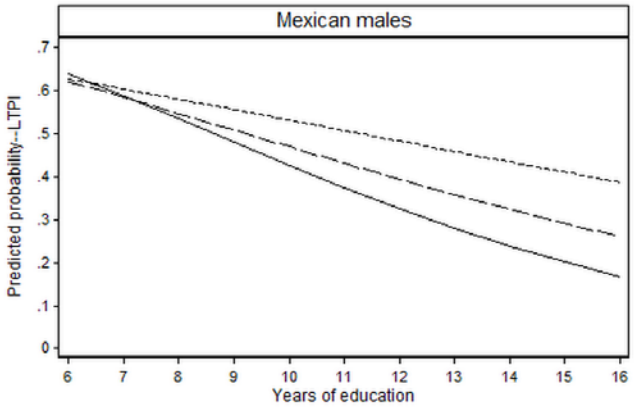
Note: OR=odds ratio, CI=confidence interval

Figure 1. Predicted probabilities of smoking and leisure-time physical inactivity by education and nativity/age at immigration (NHIS 2000-2008)

A. Smoking



B. Leisure-time physical inactivity



US-born Immigrated at/before age 15 Immigrated after age 15

*Note: Although Mexican males and Asian Indian males are depicted, patterns do not vary by subgroup in either the Hispanic or Asian population or by gender. These particular groups were selected for illustrative purposes only.