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Race, Ethnicity, And The Education Gradient In Health

Education is a more powerful determinant of health behaviors and outcomes for certain racial/ethnic groups than for others.

by Rachel Tolbert Kimbro, Sharon Bzostek, Noreen Goldman, and Germán Rodríguez

ABSTRACT: Using pooled data from the 2000–2006 National Health Interview Survey, we document how the relationship between education and a broad range of health measures varies by race/ethnicity and nativity. We found that education is a more powerful determinant of health behaviors and outcomes for some groups than it is for others. In addition, the education differentials for foreign-born groups are typically more modest than those for corresponding native-born populations. We also show how the education-health relationship varies across Hispanic and Asian subgroups. We argue that any intervention for eliminating health disparities must take these patterns into account. [*Health Affairs* 27, no. 2 (2008): 361–372; 10.1377/hlthaff.27.2.361]

I NTEREST IN THE RELATIONSHIP BETWEEN socioeconomic status (SES) and health is longstanding.[1] Many studies demonstrate the existence of a social "gradient" in health—that is, a positive relationship between SES and health at all levels of the social hierarchy. This gradient has been identified in men and women, the young and the old, and a large number of countries.[2] Despite the pervasiveness of the social gradient in health, we hypothesize that the strength of the association between SES and health varies by U.S. subpopulations. Such variations could result both from racial/ethnic disparities in power and resources and from the selection and assimilation of immigrants. Well-documented heterogeneity in health outcomes and behaviors by race/ethnicity and nativity status might also generate variability in the strength of the association between SES and health across groups.[3] For instance, the "Hispanic paradox" refers to the finding that Hispanics, particularly the foreign-born, often fare better than expected, given their typically low levels of SES, on both morbidity and mortality outcomes.[4] Other

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work has shown that the foreign-born, regardless of race/ethnicity, tend to fare better on a wide variety of health outcomes compared to their U.S.-born counterparts.[5] This work has led to questions about the reasons for health advantages among the foreign-born and to hypotheses about immigrants' adaptation and the "healthy immigrant effect," which postulates that health differentials among the foreign-born and native-born are driven by higher migration rates among healthier people.[6]

Our paper unites work on racial, ethnic, and nativity disparities in health with that of scholars investigating differences in the SES-health relationship across racial and ethnic groups for specific health outcomes.[7] More-comprehensive analyses for children and adults examine education gradients for several health outcomes and racial/ethnic groups; they find "flatter" gradients for Hispanics compared to other racial/ethnic groups.[8] In other words, Hispanics exhibit a weaker relationship between education and health than other groups. Nativity and country of origin may also play roles in distinguishing gradients, as foreign-born Hispanics generally have more modest associations between education and health than U.S.-born Hispanics, and Mexicans and Central/South Americans may have weaker relationships between education and health than other Hispanics.[9]

This prior work provides the motivation for the current paper. In addition to describing the variation in the education-health association across groups, we address several questions that have emerged from the recent studies described above: whether the expected SES and health gradient is evident for all racial/ethnic groups; whether the weaker gradients observed for Hispanics are unique or if similar patterns characterize other racial/ethnic groups as well; whether the weaker gradients observed for foreign-born Hispanics compared to the native-born are indicative of a more widespread nativity differential; and, to the extent that Hispanics and others show less pronounced stratification in health outcomes, what the underlying dynamics are.

■ **Education as our SES measure.** Although we could have focused on occupation or income, we chose education as our measure of SES because many people work outside of the paid workforce, and education determines, to a large extent, occupational status and income.[10]

■ **Building on previous research.** Our paper builds and improves upon the existing literature in several ways. First, we present the results of a comprehensive analysis of the education-health gradient across the four major U.S. racial/ethnic groups (non-Hispanic whites, non-Hispanic blacks, Hispanics, and Asians), using nationally representative data. We accounted for potential nonlinearities in the education-health relationship by incorporating education into our models as categories. We further examined the gradients by nativity status and then by subgroups for Hispanic and Asians, because of the extensive cultural, health, and socioeconomic heterogeneity within these ethnic groups.[11] Additionally, we used self-reported health behaviors and outcomes as our health measures, which reduces the potential

for health care access and utilization bias. This concern is particularly salient when studying immigrant and low-income groups.

Study Data And Methods

■ **Data.** We used pooled data on adults ages 25–64 from the 2000–2006 National Health Interview Survey (NHIS) for a total sample size of 147,039, including U.S.- and foreign-born whites, blacks, Hispanics, and Asians (Exhibit 1). The NHIS, conducted continuously since 1957, is the principal source of information on the health of the U.S. civilian, noninstitutionalized population. The sampling and weighting designs of the survey enabled us to combine seven years of data to increase our sample size and present results representative of the U.S. population.

■ **Outcome measures.** We considered six dichotomous health outcomes and behaviors: current smoking (every day or some days), heavy drinking (more than five drinks on at least one occasion in the past year), work limitations (physical, mental, or emotional problems), obesity (body mass index [BMI] exceeding 30.0), fair or poor self-reported health, and low physical activity (vigorous exercise less than once per week).

The outcome variables were constructed so that we consistently modeled the probability of an unhealthy behavior or outcome. These measures give a broad overview of the health of the respondents, but several of them—especially health status and work limitations—have subjective components that may be affected by racial/ethnic and nativity differences in reporting. Nevertheless, results that are consistent for a variety of measures are likely to signify systematic health differ-

EXHIBIT 1
Weighted Descriptive Statistics For The 2000–2006 National Health Interview Survey

Characteristic	All	USB whites	FB whites	USB blacks	FB blacks	USB Hispanics	FB Hispanics	USB Asians	FB Asians
Race/ethnicity and nativity classification									
Number	147,039	89,240	4,219	19,428	2,083	10,776	16,391	750	4,152
Male	49%	49%	50%	44%	49%	48%	53%	54%	49%
Age (years), mean	43.7	44.6	43.6	42.8	41.5	40.8	40.2	41.7	41.8
Education									
Less than high school	14%	9%	9%	18%	13%	21%	55%	3%	10%
H.S. degree or equiv.	29	30	23	33	26	32	20	11	17
Some college	29	30	24	32	32	32	15	27	18
College degree or more	28	31	44	17	29	15	10	59	55
Smoking	24	26	22	26	9	22	14	17	12
Heavy drinking	21	23	18	13	7	24	17	20	7
Work limitations	10	10	6	14	4	10	5	6	3
Obese	26	25	16	37	23	35	22	15	6
Low activity	61	57	60	68	64	64	76	46	68
Fair/poor health	10	9	8	18	9	14	12	6	6

SOURCE: Authors' analysis of data from the National Health Interview Survey, 2000–2006.
NOTES: USB is U.S.-born. FB is foreign-born.

ences across groups.

■ **Explanatory variables.** The explanatory variables for the models include education, race/ethnicity and nativity, age, and sex. Race/ethnicity and nativity are self-reported. Our base model distinguished eight groups: U.S.- and foreign-born whites, blacks, Hispanics, and Asians. We then looked in more detail at Hispanics and Asians. For Hispanics we used eight subgroups (U.S.- and foreign-born Puerto Ricans, Mexicans, and Central/South Americans; Cubans; and other Hispanics). For Asians we used four categories (Asian Indians, Chinese, Filipinos, and other Asians). We did not have sufficient numbers to allow for additional analyses by nativity within Asian national groups. Education is represented by four categories of schooling: less than a high school education, a high school or equivalency degree, some college, and a college degree or more.

The sample is restricted to people ages 25–64, because schooling is more likely to be completed by age twenty-five than earlier. To account for the potentially nonlinear relationship between age and the health outcomes, age was modeled using natural cubic splines, which provide a flexible functional form for the relationship between age and the outcome of interest.[12] Sex is represented as an indicator variable for male. To ascertain whether there are significant differences in the education-health associations across groups, we also included interaction terms between education and the various race/ethnicity/nativity designations. The models also include all other two-way interaction terms to account for the ways in which age, sex, ethnicity and nativity, and education combine to influence health outcomes. It is especially important to allow for the interaction of age with the other measures because age profiles vary across the ethnicity and education groups, and initial analyses indicated that these interactions were statistically significant.

■ **Logistic regression models.** We estimated a series of logistic regression models, adjusting for the clustered sampling design and stratification used in the NHIS and weighting the data appropriately. Separate models were estimated for each health outcome, with each model including the variables detailed above. We excluded respondents who were missing values on education (1 percent of the sample), those who did not report one of the major racial/ethnic categories (2 percent of the sample), and those who were missing on the given outcome variable (ranging from less than 1 percent for asthma to approximately 6 percent for obesity). Thus, the effective sample size for each model varies depending on the outcome being considered. Because of the complexity of the models and the large number of groups considered, we calculated predicted probabilities for each health outcome or behavior.

■ **Comparing gradients across groups.** Our focus in this analysis was on comparing gradients across groups; we looked at the differences in the likelihood of particular health outcomes and behaviors between those with a high school education and those with a college education.[13]

Study Results

■ **Descriptive data.** Exhibit 1 provides weighted descriptive statistics for the entire sample and for each major subgroup.[14] The proportion of each group with a college degree varies from a low of 10 percent for foreign-born Hispanics to a high of 59 percent for U.S.-born Asians. Fully 55 percent of foreign-born Hispanics have less than a high school education. For nearly every outcome and group, the foreign-born report better health or health behaviors than their U.S.-born counterparts. The only exception is for low physical activity, for which foreign-born whites, Hispanics, and Asians have higher frequencies than their U.S.-born counterparts.

Exhibits 2 through 7 present a series of graphs showing the gradient, or difference in predicted probabilities between high school and college graduates, for each outcome; the probabilities are evaluated at the median age of the sample (forty-three).[15] Estimated probabilities for ages thirty-four and fifty-two (the lower and upper age quartiles of the sample) are similar to those at age forty-three and are not shown here. These graphs provide information on the magnitude of the education differential for each health outcome and the prevalence of the outcome by levels of education. We present only the results for men, because the results are generally similar for women.[16]

■ **"Steepness" of the education gradient.** For each outcome, the graphs consist of one bar for each race, ethnic, and nativity group. The length of the bar represents the difference between the predicted proportion of unhealthy outcomes for men with a high school education and the corresponding prediction for men with a college degree. This summary measure reflects the magnitude of the education differential, or "steepness" of the education gradient, for that group and that outcome. Although this is only one of many measures of the strength of the education-health association that we could have chosen, and the magnitude is likely to vary considerably across alternative measures, it has the advantage of simplicity and enables us to
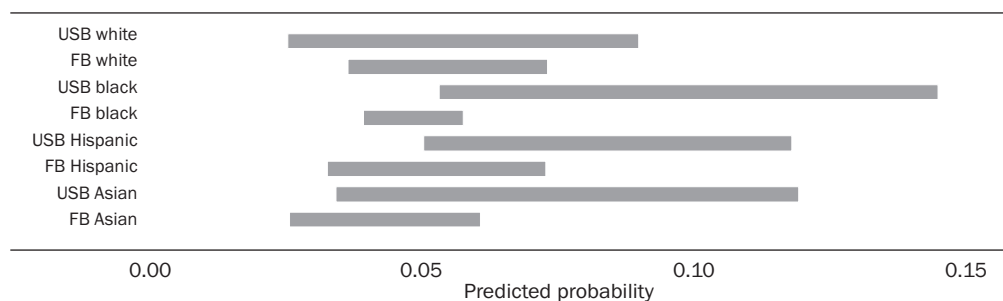
EXHIBIT 2
Current Smoking: Predicted Gradients For Race/Ethnicity And Nativity Categories, Men, Age 43
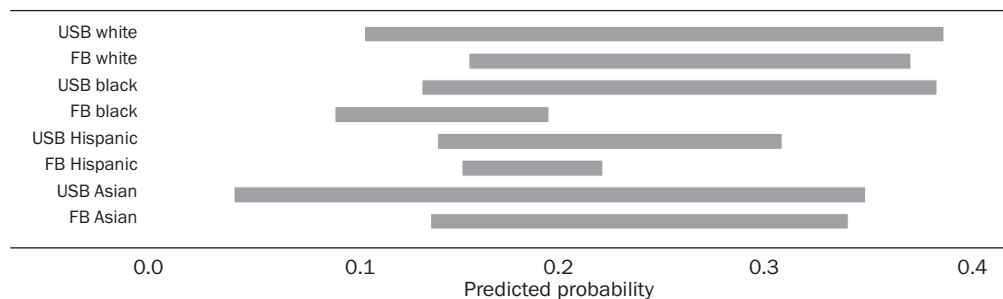
SOURCE: Authors' analysis of data from the National Health Interview Survey, 2000–2006.
NOTES: Each bar starts with the predicted probability for college graduates and ends with the corresponding prediction for high school graduates, so the length represents the estimated educational gradient or difference between high school and college. USB is U.S.-born. FB is foreign-born.
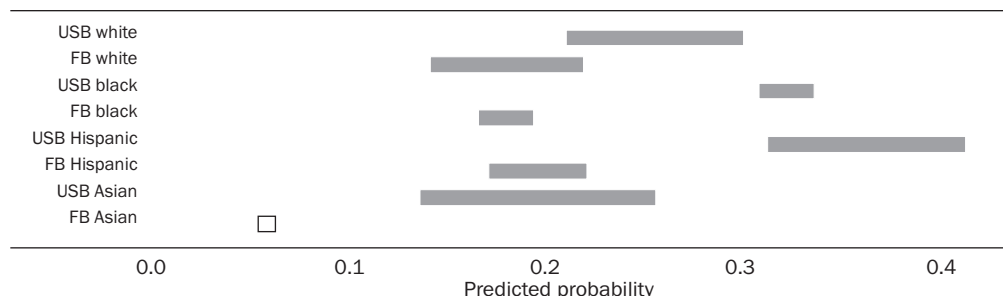
EXHIBIT 3

Fair/Poor Health: Predicted Gradients For Race/Ethnicity And Nativity Categories, Men, Age 43

SOURCE: Authors' analysis of data from the National Health Interview Survey, 2000–2006.
NOTES: For explanation of gradient bars, see Exhibit 2 notes. USB is U.S.-born. FB is foreign-born.

present both mean levels and variability in graphical form.[17] Because the scale of the *x* axis varies across outcomes, comparisons based on the lengths of the bars are legitimate within but not across outcomes. The graphs summarize the information from our models and highlight the nativity patterns noted earlier: in comparison with the native-born, foreign-born groups generally have (1) lower probabilities of negative health outcomes and behaviors (the bars are clustered at lower values) and (2) smaller differentials by education (the bars are shorter).

■ **Variations in the education gradient.** For each outcome, the educational gradient in health differs greatly across the eight race/ethnicity/nativity groups considered. Although we found that for nearly every group and every outcome, those with higher levels of education are healthiest, the supplemental tables (presented online) show that these relationships are not necessarily monotonic.[18] In addition, some groups have relatively small differentials (flat gradients), whereas others have considerably larger (or steeper) ones. The particular groups that differ vary by outcome, and no group consistently has the steepest or flattest gradient. For example, al-

EXHIBIT 4

Obesity: Predicted Gradients For Race/Ethnicity And Nativity Categories, Men, Age 43

SOURCE: Authors' analysis of data from the National Health Interview Survey, 2000–2006.
NOTES: For explanation of gradient bars, see Exhibit 2 notes. The hollow bar for foreign-born Asians corresponds to a negative gradient where the sample proportion obese is higher for college graduates than high school graduates. USB is U.S.-born. FB is foreign-born.

EXHIBIT 5
Work Limitations: Predicted Gradients For Race/Ethnicity And Nativity Categories, Men, Age 43
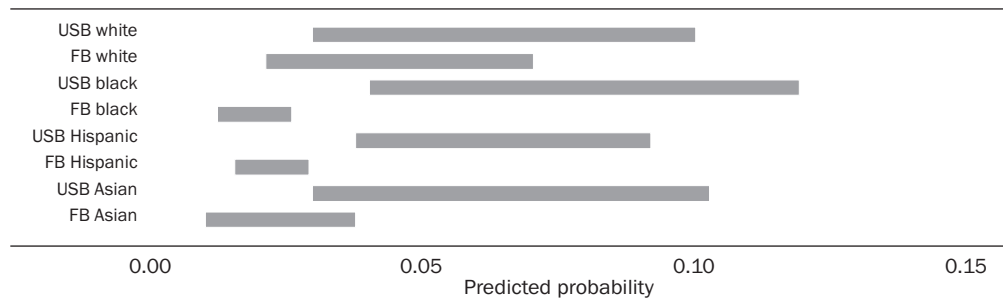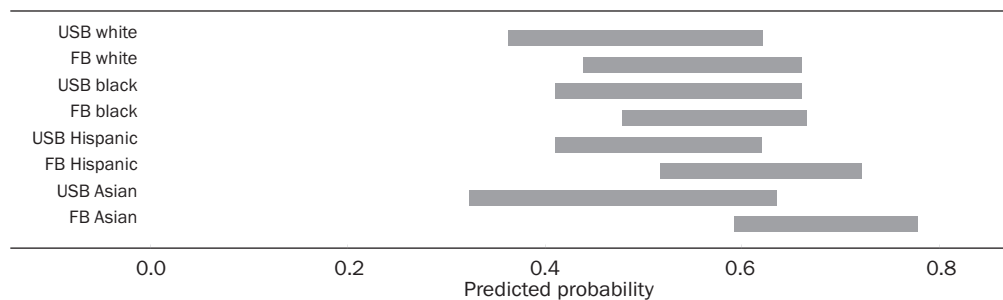

SOURCE: Authors' analysis of data from the National Health Interview Survey, 2000–2006.
NOTES: For explanation of gradient bars, see Exhibit 2 notes. USB is U.S.-born. FB is foreign-born.

though Hispanics (both U.S.- and foreign-born) have smaller gradients than other U.S.- and foreign-born groups for current smoking, this pattern does not characterize the other outcomes. Nevertheless, for the outcomes of smoking and work limitations, our results support the earlier finding that foreign-born Hispanics tend to have smaller gradients than their native-born counterparts.

■ **Nativity differential among non-Hispanics.** Our results also suggest that this nativity differential is not limited to Hispanics. In fact, we found large, significant differences by nativity for smoking, fair/poor health, work limitations, and binge drinking for most racial/ethnic groups. (Some nativity differences for Asians are large but are estimated imprecisely because of small sample sizes, particularly at the lower end of the educational distribution.)

■ **Health outcomes among less-educated groups.** The results also reveal that these smaller gradients for the foreign-born are largely attributable to relatively good outcomes among those with less education. At lower levels of education, the foreign-born generally exhibit more positive health outcomes and behaviors than

EXHIBIT 6
Low Physical Activity: Predicted Gradients For Race/Ethnicity And Nativity Categories, Men, Age 43

SOURCE: Authors' analysis of data from the National Health Interview Survey, 2000–2006.
NOTES: For explanation of gradient bars, see Exhibit 2 notes. USB is U.S.-born. FB is foreign-born.

EXHIBIT 7
Binge Drinking: Predicted Gradients For Race/Ethnicity And Nativity Categories, Men, Age 43
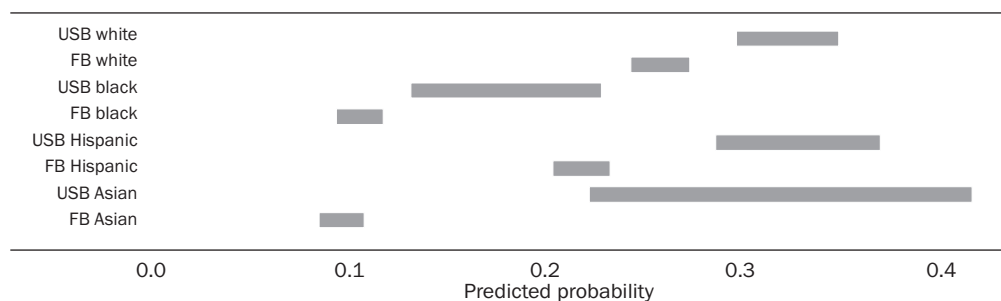
SOURCE: Authors' analysis of data from the National Health Interview Survey, 2000–2006.
NOTES: For explanation of gradient bars, see Exhibit 2 notes. USB is U.S.-born. FB is foreign-born.

their U.S.-born counterparts, but this is not observed at higher levels of education, thereby generating flatter education gradients in health. We also found differences in the size of gradients across outcomes. Smoking has relatively large gradients across groups, while binge drinking and obesity have much smaller gradients, which suggests that the impact of schooling varies across health-related behaviors.

■ **Gradients for racial/ethnic subgroups.** In the next stage of the analysis, we performed the same predictions for the detailed racial/ethnic subgroups. Foreign-born Mexicans have a flatter gradient for smoking compared to U.S.-born whites and a flatter gradient in obesity compared to U.S.-born whites and U.S.-born Mexicans. Foreign-born Central/South Americans also have flatter gradients than U.S.-born whites for several outcomes.[19]

The results for Asians suggest that there are differences in gradients between the subgroups for most of the outcomes considered (except binge drinking and low activity levels) but that the statistically significant differences seem to be between U.S.-born whites and the Asian subgroups, rather than among Asian subgroups.[20]

Discussion

Our finding that the foreign-born fare better across race/ethnicity groups for almost all of the health outcomes considered here confirms results from previous research that immigrants tend to have better morbidity and mortality outcomes than the native-born.[21] For all outcomes except physical activity, our estimates also suggest that the smaller differences in health measures between the high- and low-education groups among the foreign-born are due to a substantial degree to relatively favorable outcomes among groups at the lower end of the education distribution. This is consistent with recent research suggesting that the mortality and birthweight advantages experienced by Hispanics are largely driven by the fact that Hispanics at the lower end of the SES distribution fare better than expected, given their level of SES.[22]

"Interventions targeted at particular groups may be more effective than those aimed at broader populations."

....

We propose several explanations for the finding that lower-educated foreign-born people have better health outcomes than their U.S.-born counterparts. These are similar to arguments that have been put forward to explain the Hispanic paradox, the health advantage of immigrants, and differences in SES gradients between Hispanics and whites.[23]

■ **"Healthy migrant" effect.** Two explanations pertain to immigration patterns. One frequently evoked hypothesis relates to the "healthy migrant" effect, whereby people who immigrate to the United States may be healthier than those who remain in their home countries. This selective migration process may be more prevalent among those of lower SES.[24] Unfortunately, the data available to test the healthy migrant effect are woefully inadequate, and there has been no assessment of the extent to which this process varies by SES.

■ **Different SES-health relationships.** A second explanation pertains to the presence of different or even reversed SES-health relationships in sending countries as compared with the United States. For instance, although trends are changing, smoking has been more prevalent among the upper classes in Mexico and other Latin American countries than among the lower classes, and higher-income people in Mexico have higher rates of obesity and excessive alcohol consumption than lower-income Mexicans do.[25] Thus, poor immigrants from those countries are relatively unlikely to exhibit these health behaviors or related health problems at home and may be less likely to engage in them when they arrive in the United States.

■ **Assimilation process.** An alternative set of explanations relates to the assimilation or acculturation process that immigrants face when adapting to life in the United States. Cassio Turra and Noreen Goldman speculate that with increasing duration in the United States, stress and racism faced by immigrants—even those who are relatively well-off—may weaken some of the pathways that link higher SES to better health among native-born groups.[26] In addition, if particular behaviors such as heavy drinking or smoking are uncommon in immigrants' sending countries, then the benefit that U.S.-born groups experience from higher levels of schooling in reducing the prevalence of such behaviors is likely to be more modest among the foreign-born. In other words, there may be less "room for improvement" among foreign-born groups.

■ **Limitations of the analysis.** We note two important limitations of this analysis. One is our exclusive focus on education. Other measures of SES—most notably income, occupational status, and wealth—are likely to account for some of the observed education differences in health and to have associations with education and health that vary by race, ethnicity, and nativity.[27]

A second limitation pertains to variation in the significance of particular levels

of schooling across groups. For example, highly educated immigrants might not achieve similar levels of social status as their similarly educated U.S.-born counterparts, because of barriers related to legal status and language. It is also unlikely that a college degree is comparable across countries of origin, either in educational quality or in economic returns in the labor market.[28] Thus, future work on ethnicity differences in social inequality should consider more-complex measures of SES.

■ **Importance of education.** Understanding and addressing socioeconomic disparities in health is a topic of great concern to health researchers and policymakers. It is critical for these and other interested groups to recognize that education is a more powerful determinant of health status for some racial/ethnic and nativity groups than it is for others. Interventions targeted at particular groups may be more effective than those aimed at broader populations. For instance, U.S.-born children of immigrants, who tend to be more highly educated than their parents, nevertheless may be an important target group for interventions to halt the deterioration of health behaviors and outcomes that occurs between the first and second generations. Given the heterogeneity of the U.S. immigrant population, however, any intervention must take into account racial/ethnic group as well as nativity status.

■ **Potential trends.** Research that seeks to understand the origins of SES and health gradients will be crucial to eliminating disparities and to predicting how disparities may shift in coming decades. Many lower-SES immigrant groups in the United States today have generally positive health behaviors and outcomes, but as gradients shift in sending countries, health advantages for these immigrant groups are likely to erode. It is therefore essential for health researchers and policymakers to understand these potential trends, if policies and interventions are to achieve their intended results. The SES-health paradigm must become more flexible to incorporate differences in the way education influences health across race/ethnicity and nativity status, and it must be sensitive to the complex mechanisms that generate those differences. We believe that this more nuanced paradigm is necessary for understanding—and reacting to—the ways in which SES, health, and race/ethnicity and nativity are related, both now and in the future.

NOTES

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2. See, for example, M. Marmot and R.G. Wilkinson, *Social Determinants of Health* (New York: Oxford University Press, 1999); J.S. House et al., "The Social Stratification of Aging and Health," *Journal of Health and Social Behavior* 35, no. 3 (1994): 213–234; and N. Goldman, "Social Inequalities in Health: Disentangling the Underlying Mechanisms," *Annals of the New York Academy of Sciences* 954 (2001): 118–139.

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4. See, for example, J.W. Collins Jr. and D.K. Shay, "Prevalence of Low Birth Weight among Hispanic Infants with United States–Born and Foreign-Born Mothers: The Effect of Urban Poverty," *American Journal of Epidemiology* 139, no. 2 (1994): 184–192; and L.K. Khan, J. Sobal, and R. Martorell, "Acculturation, Socioeconomic Status, and Obesity in Mexican Americans, Cuban Americans, and Puerto Ricans," *International Journal of Obesity* 21, no. 2 (1997): 91–96.

5. Hummer et al., "Race/Ethnicity, Nativity, and U.S. Adult Mortality"; S. Sharma et al., "Racial, Ethnic, and Socioeconomic Disparities in the Clustering of Cardiovascular Disease Risk Factors," *Ethnicity and Disease* 14, no. 1 (2004): 43–48; and D. Acevedo-Garcia, M.J. Soobader, and L.F. Berkman, "The Differential Effect of Foreign-Born Status on Low Birth Weight by Race/Ethnicity and Education," *Pediatrics* 115, no. 1 (2005): e20–e30.

6. A. Palloni and E. Arias, "Paradox Lost: Explaining the Hispanic Adult Mortality Advantage," *Demography* 41, no. 3 (2004): 385–415.

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8. E. Chen, A.D. Martin, and K.A. Matthews, "Socioeconomic Status and Health: Do Gradients Differ within Childhood and Adolescence?" *Social Science and Medicine* 62, no. 9 (2006): 2161–2170; N. Goldman et al., "Socioeconomic Gradients in Health for White and Mexican-Origin Populations," *American Journal of Public Health* 96, no. 12 (2006): 2186–2193; and D. Acevedo-Garcia, M.J. Soobader, and L.F. Berkman, "Low Birthweight among U.S. Hispanic/Latino Subgroups: The Effect of Maternal Foreign-Born Status and Education," *Social Science and Medicine* 65, no. 12 (2007): 2503–2516.

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10. R. Karasek and T. Theorell, *Healthy Work: Stress, Productivity, and the Reconstruction of Working Life* (New York: Basic Books, 1992).

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12. P. Smith, "Splines as a Useful and Convenient Statistical Tool," *American Statistician* 33, no. 2 (1979): 57–62.

13. Statistically significant differences in gradients were identified for each outcome as follows. First, we conducted a Wald test of the hypothesis that the gradient, defined here as the difference in predicted probabilities for high school and college graduates, evaluated at the median age, is the same for all ethnic/nativity groups. Where this hypothesis was rejected, we followed up with a series of pairwise Bonferroni t-tests to determine which groups differ from each other, testing that the gradient at the median age is the same for the two groups being compared. Of particular interest are comparisons of each group with native-born whites, and of each foreign-born group with its native-born counterpart. The full results from all analyses are available upon request from the authors, and more detailed tables and figures for the subgroup analyses are available in an online appendix at http://content.healthaffairs.org/cgi/content/full/27/2/361/DC1.

14. Online Appendix Table 1 (available as in Note 13) shows similar statistics for the more detailed breakdowns of Hispanics and Asians.

15. Online Appendix Table 2 (available as in Note 13) shows the predicted probabilities for each education category as well as the gradients and the results of the significance tests.

16. Full results for women are available upon request from the authors.

17. J.P. Mackenbach and A.E. Kunst, "Measuring the Magnitude of Socio-Economic Inequalities in Health: An Overview of Available Measures Illustrated with Two Examples from Europe," *Social Science and Medicine* 44, no. 6 (1997): 757–771.

18. These are available as in Note 13.

19. See online Appendix Table 3 and Figure 1; ibid.

20. See online Appendix Table 4 and Figure 2; ibid..

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