Generation, Language, Body Mass Index, and Activity Patterns in Hispanic Children

Sharon E. Taverno, MS, **Brandi Y. Rollins, MS**, and **Lori A. Francis, PhD**
From the Department of Biobehavioral Health (Taverno, Francis) and Department of Human Development and Family Studies (Rollins), Pennsylvania State University, University Park, Pennsylvania

Abstract

Background—The acculturation hypothesis proposes an overall disadvantage in health outcomes for Hispanic immigrants with more time spent living in the U.S., but little is known about how generational status and language may influence Hispanic children's relative weight and activity patterns.

Purpose—The association between generation and language was investigated with relative weight (BMI z-scores), physical activity, screen time, and participation in extracurricular activities (e.g., sports, clubs) in a U.S.-based, nationally representative sample of Hispanic children.

Methods—Participants included 2,012 Hispanic children aged 6–11 years from the cross-sectional, 2003 National Survey of Children's Health. Children were grouped according to generational status (1st, 2nd or 3rd), and the primary language spoken in the home (English vs non-English). Primary analyses included adjusted logistic and multinomial logistic regression to examine the relationships among variables; all analyses were conducted between 2008 and 2009.

Results—Compared to 3rd generation, English speakers, 1st and 2nd generation, non-English speakers were over two times more likely to be obese. Moreover, 1st generation, non-English speakers were half as likely to engage in regular physical activity and sports. Both 1st and 2nd generation, non-English speakers were less likely to participate in clubs compared to 2nd and 3rd generation, English speakers. Overall, all non–English speaking groups reported less screen time compared to 3rd generation, English speakers.

Conclusions—The hypothesis that Hispanics lose their health protection with more time spent in the U.S. was not supported in this sample of Hispanic children.

Introduction

Hispanics have become the largest racial/ethnic minority group in the U.S., and are projected to constitute one quarter of the total U.S. population by 2050 (U.S. Census, 2008). Recently, immigrants and their U.S.-born children are making up an increasing proportion of the total

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U.S. population,[1] the majority of which are of Hispanic or Asian origin.[2] Children of immigrants have contact with multiple cultural influences, which ultimately can affect their health status and behaviors.[3] Research suggests that social, economic, and environmental factors, as well as access to health care, influence the health of populations.[4,5] Studies have shown that adult immigrants tend to have better health, longer life expectancy and lower mortality rates when compared to their U.S.-born counterparts.[6–8] However, studies have also demonstrated that this health protection tends to decrease with more time spent in the U.S.

The acculturation hypothesis, proposes an overall disadvantage in health outcomes for Hispanic immigrants with more time spent living in the U.S.[9,10] Acculturation has been defined as the process by which immigrants adopt the attitudes, values, customs, beliefs and behaviors of a new culture.[11] Previous studies have linked acculturation in Hispanic adults with various negative health outcomes including obesity, low fruit and vegetable intake, high fat and sugar intake, smoking, and alcohol consumption;[12] however, the findings relating physical activity to acculturation in this adult population have been inconsistent. Several studies report a positive association between acculturation and physical activity,[13–20] while others have shown a relationship between higher acculturation and lower levels of physical activity in Hispanic adults.[21,22] Therefore, it is not clear whether patterns of physical activity behaviors in Hispanic adults are consistent with the acculturation hypothesis. It is evident that the influence of acculturation on Hispanic health behaviors and outcomes is quite complex and not well understood.[23] While there have been many studies examining the influence of acculturation on health behaviors in adults, little is known about the effects of acculturation on health behaviors in Hispanic children.

Of the few studies that have investigated the role of acculturation on health outcomes in Hispanic youth, most have observed a relationship between acculturation and poorer health and health behaviors.[24–29] Similar to what is found in the adult and adolescent literature, there seems to be a trend for BMI to increase with subsequent generations in the U.S. for Hispanic children.[24,27,29] However, to the author's knowledge, very few data exist which examine screen time or extracurricular activity prevalence in Hispanic immigrant children. Of the studies the authors identified that examine the association between acculturation and physical activity in Hispanic immigrant children, the results have been conflicting, and include a wide variety of measures to estimate acculturation or physical activity.[3,25,27,30–33] The purpose of the present study is to investigate associations among generational status and language with relative weight (BMI z-scores), screen time, physical activity patterns and sport and club participation in a nationally representative sample of Hispanic children aged 6–11 years living in the U.S.

Methods

Participants

Data were drawn from participants in the 2003 National Survey of Children's Health (NSCH), a nationally representative sample of children aged 0–17 years in the U.S. This random-digit-dial survey was conducted by the Health Resources and Services Administration's Maternal and Child Health Bureau (MCHB) in collaboration with the CDC's National Center for Health Statistics (NCHS). Details on the survey design are described elsewhere.[34,35] A Spanish-language version of the NSCH questionnaire was created after extensive review and evaluation for accuracy and cultural appropriateness by a team of experienced Spanish-language telephone interviewers and supervisors. In Spanish-speaking households, NSCH interviews were administered in Spanish by a trained bilingual interviewer; families were given the choice to respond in either English or Spanish. In the present study, the full NSCH sample (N =102,353) was limited to Hispanic children aged 6–11 years (n = 3914). Further, children were excluded if they were underweight (n = 210) or had missing data on gender (n = 2), BMI category (n =

1358), language ($n = 113$), poverty ($n = 472$), screen time ($n = 40$), sports ($n = 14$) and club participation ($n = 8$), and weekly physical activity ($n = 58$), resulting in a final sample of 2,022 children. This study was deemed exempt by the Pennsylvania State University IRB.

Measures

Generational Status—Child's generational status was based on parental report of whether the child and his or her parents were born in the U.S. Generational status was coded according to recommendations from the IOM report on immigrant children: 1st generation—an immigrant to the U.S. not preceded by parents or other family members; 2nd generation—U.S.-born child of a 1st generation immigrant; and 3rd generation—U.S.-born child of a 2nd generation immigrant.[36]

Language—Child's language was assessed by asking parents "What is the primary language spoken in your home?" Responses were recoded to 0 (English), and 1 (non-English). See Table 1 for a breakdown of generation groups by language. The 1st generation, English speaking group consisted of only 10 children and thus, was excluded from this study.

Weight Status—Based on parent-reported child height and weight, age- and gender-specific BMI z-scores were computed using the CDC Growth Charts.[37] Child BMI categories were based on the 2007 Expert Committee recommendations[38] adopted by the CDC: normal weight (BMI <85th percentile and >5th percentile), overweight (BMI ≥ 85th percentile and < 95th percentile), and obese (BMI ≥ 95th percentile). Underweight children (BMI ≤5th percentile) were not included in the sample.

Physical Activity—Children's participation in physical activity was determined by asking parents how many days in the past week their child exercised or participated in physical activity for ≥20 minutes that made him or her breathe hard and sweat (i.e, basketball, running, or fast bicycling); response options ranged from 0 to 7. The variables no physical activity (yes=1/no=0) was defined as no reported days of physical activity per week, and regular physical activity (yes=1/no=0) as 3 or more days of physical activity per week.[39]

Screen time—Parents reported the average number of hours their child spends watching TV, videos, or playing video games on a typical school day; response options ranged from 0 to 24. For the purposes of this study, this variable was recoded to 0 (≤2 hours/day) and 1 (>2 hours/day) based on the American Academy of Pediatrics (AAP) recommendations for children.[40]

Sports participation—Parent's responded yes or no to whether their child was on a sports team or took sports lessons after school or on the weekends in the past 12 months.

Club participation—Parent's responded yes or no to whether their child participated in any clubs or organizations after school or on the weekends in the past 12 months (i.e., Scouts, a religious group, or Boy/Girl's club).

Covariates—Income, household education, child age and gender were included as covariates in the analyses. Highest education level in the household was coded as 0 (<12 years), 1 (12 years), 2 (>12 years). Child's gender was coded as 0 (male), 1 (female). Income was coded as "poor" (below 133% poverty), "near poor" (at 133% poverty and below 185% poverty), and "not poor" (at or above 185% poverty) based on 2002 and 2003 USDHHS Federal Poverty Guidelines for households.

Statistical Analysis

All data analyses were completed between 2008 and 2009 using STATA 9.1 (Stata Corporation, College Station, TX) to account for complex sample design.[41] All proportions and means were weighted to provide estimates for the population of Hispanic children living in the U.S. Associations between generation and language groups for weight status, physical activity, screen time, and club and sports participation were investigated using adjusted logistic and multinomial logistic regression, followed by post hoc multiple comparisons. Logistic regression analyses allowed us to account for unequal sample sizes and each model was adjusted for the covariates: household income and education, and child age and gender. The authors hypothesized that these covariates would have influence on Hispanic children's physical activity and screen time. In each model, the generation and language groups were dummy coded and the 3rd generation, English group served as the comparison group. This group was selected as the comparison because they were the group living the longest in the U.S., and whose primary language was English. To examine whether the odds of the dependent variables differed among the noncomparison generation and language groups (i.e., 2nd generation, English versus 2nd generation, non-English), post estimation commands in STATA were used to run unadjusted and Bonferroni adjusted post hoc multiple comparisons (p<.05) following each model.

Results

Weighted sample descriptives by generation and language groups are presented in Table 2. The average age of the respondent's children was 8.7 years, and 50% were women. Over one half of the children resided in poor or near poor households; yet, nearly 50% of the households had education levels exceeding 12 years. The overall proportions of obese and overweight children were 39.5% and 18.8%, respectively. Rates of obesity were highest among 1st and 2nd generation, non-English speakers, and over one quarter of 3rd generation, non-English speakers were overweight. Screen time, physical activity, and sports and club participation were highest among 2nd and 3rd generation, English speakers and lowest among 1st generation, non-English speakers. Of note, the level of occurrence of no physical activity was highest among 1st generation, non-English speakers, followed by 2nd and 3rd generation, non-English speakers. Second generation, English speakers reported the highest club participation rate.

For the 1st and 2nd generation, non–English speaking children, the adjusted odds of being overweight or obese were significantly greater compared to the 3rd generation, English speakers (Table 3). For example, 2nd generation, non-English speakers were 2.8 and 2.2 times more likely to be overweight and obese, respectively, and 1st generation, non-English speakers were 2.8 times more likely to be obese relative to the comparison group. In contrast, the odds of exceeding 2 hours of daily screen time was lower among the non–English speaking groups compared to 3rd generation, English speakers. The odds of having >2 hours of daily screen time were 60% less in 1st generation, non-English speakers, 47% less in 2nd generation, non-English speakers, and 76% less in 3rd generation, non-English speakers compared to 3rd generation, English speakers.

Overall, the non–English speaking groups were less likely to report regular physical activity, and participation in clubs and sports than the 3rd generation, English speakers. Specifically, 1st generation, non-English speakers were 2.0 times less likely to report regular physical activity and ~2.3 times less likely to participate in sports or clubs relative to 3rd generation, English speakers. In addition, 2nd generation, non-English speakers were 2.3 times less likely to participate in clubs compared to the comparison group. Unadjusted post hoc multiple comparisons revealed that all non–English speaking groups were less likely to participate in clubs than 2nd generation, English speakers (p<.05). After adjusting for multiple tests, only findings for the 1st and 2nd generation, non-English speakers remained significant. No

significant unadjusted or adjusted post hoc comparisons were found for overweight, obesity, weight status, screen time, regular physical activity, and sports participation.

Discussion

These findings suggest that 1st and 2nd generation, non–English speaking children are more likely to be obese, and 1st generation, non-English speakers have significantly lower physical activity than 3rd generation, English speaking children. This finding is distinct from is observed in the Hispanic adult and adolescent population where obesity and overweight tend to increase steadily across generations. These results also indicate that children who speak a language other than English in the home are less likely to engage in 2 or more hours of daily screen time. Finally, 1st and 2nd generation, non–English speaking children were less likely to participate in clubs, and 1st generation, non-English speakers were less likely to participate in sports after school or on the weekends. To the authors' knowledge, this is the first study to address the association between generational status and language with relative weight, physical and extracurricular activities, and screen time in a U.S.-based, nationally representative sample of Hispanic children.

Ethnic minority and other low-income populations are disproportionately affected by overweight and obesity.[42] Based on a 2006 report, almost one half of Latino children aged 6–11 years were overweight, exceeding rates of overweight in non-Hispanic white boys/men and girls/women, and black men/boys.[43] In this sample, children were more likely to be obese if they were 1st and 2nd generation, non-English speakers; this finding corroborates other studies with Hispanic children.[44,45] Generational status and language use are considered to be indirect indicators of the complex acculturation phenomenon, and are highly correlated to each other; [46] furthermore, they have been used as proxy measures of acculturation in previous studies with Hispanics.[1,14,25,27,29,30,47–49] According to the acculturation hypothesis, one would assume that children's relative weight would be lowest in the 1st generation and increase with subsequent generations; however, this was not demonstrated by the findings. This could imply that acculturation has a different association with relative weight in Hispanic children than what previous literature has shown. Although parent report of height and weight to estimate child BMI is not ideal, it was the only estimate of relative weight provided by this secondary data set. This limitation may explain why it appears as though relative weight was lower in 2nd and 3rd generation children. It is possible that parent's acculturation level, child age, or an interaction between the two introduced some self-report biases into the data.

The odds of having 2 or more hours of screen time was significantly lower for all non–English speaking groups regardless of generational status, compared the 3rd generation, English speakers. This finding supports previous studies which examined the relationship between screen time and acculturation.[30,50,51] These results would suggest that speaking a language other than English in the home appears to be a protective factor for watching less TV, videos and playing fewer video games on a typical school day. Future studies should investigate after school time use in Hispanic children to discern the activities these non–English speaking children are engaging in, apart from screen time, and how they may affect health.

Descriptively, weekly physical activity level was the lowest among the non–English speaking generation groups. Further, 1st generation, non-English speakers were significantly less physically active than 3rd generation, English speakers. These findings are consistent with two recent studies of Hispanic children and adolescents,[30,33] and add to the literature by providing a picture of generational shifts in physical activity levels for Hispanic immigrant children by language. Despite evidence for the acculturation hypothesis which suggests a decline in health behaviors over time with greater acculturation, this study implies that this may not necessarily apply to Hispanic children's physical activity behaviors. Due to the preliminary nature of the

present study, analyses were not performed to explore gender differences in physical activity by language and generation. Future studies should include analyses which look at the gender differences in physical activity for Hispanic children by acculturation level. Also, this study is limited by the fact that the physical activity measure was based on parental report in response to one question. However, at this age, parental reports are appropriate given the inability of young children to correctly recall the duration or frequency of physical activities.[52,53] Future studies should use more reliable and valid measures of child physical activity.

Lastly, the authors examined whether participation in sports and clubs differed by generation and language groups. The results showed that the odds of participating in sports were significantly lower for 1st generation, non-English speakers; this finding confirms previous research with immigrant children.[30,54] Additionally, 1st and 2nd generation, non–English speaking children were 2.3 times less likely to participate in clubs after school or on the weekends when compared to 3rd generation, English speakers. The tendency for 1st generation children to be less physically active and less likely to participate in sports and clubs could partly reflect cultural preferences; for example, immigrant families may not place high value on extracurricular activities, and may encourage the child to spend more time in academic studies, language classes, or with the family.[30,55]

It is also important to recognize the role of social context, specifically those barriers which may influence non–English speaking children's physical activity levels. Language barriers, exclusion/discrimination from social organization, and socioeconomic disadvantage could all contribute to the observed physical activity disparity.[56] Lack of English-speaking abilities, coupled with a lack of knowledge of physical activity opportunities and outlets in the community may prevent less acculturated children from participating in physical activities, particularly if parents are primarily responsible for fostering children's participation in these activities. While the authors attempted to control for SES by adjusting for household income and education, the role of context, culture and other socioeconomic factors in influencing physical activity access and behavior cannot be denied. More research is needed to explore the complex relationships among culture, SES, acculturation and physical activity participation among Hispanic children, as well as sports and club participation in immigrant children. It is possible that the findings of this study vary by Hispanic subgroup, but due to the limitations of using a secondary data set, the authors were unable to explore this possibility. It is evident that Hispanic subgroups differ substantially in historic, sociocultural, and economic backgrounds, and thus in their health and disease experience.[9] Future population-based studies should gather additional demographic data, such as country of origin, as well as other family and neighborhood data, to give a more complete picture of the heterogeneity that exists within these populations.[57,58]

While few researchers would discount the importance of considering acculturation when examining health behaviors and outcomes in Hispanic immigrants, many would agree that the way it is currently measured can be problematic. Proxy measures, while widely used, are limited in scope and sensitivity because they do not directly measure acculturative change, that is, changes in attitudes, values or behaviors.[59] Thomson and Hoffman-Goetz (2009) in their review of measures of acculturation for Hispanic populations found that only two acculturation scales were theory-based.[59–61] Additional theoretic models are needed to paint a more complete picture of the associations among specific components of acculturation and health outcomes.13 The measurement of acculturation, however, is complex. Originally, acculturation was thought to be a linear process whereby immigrants moved from exclusive involvement in the native culture, to exclusive involvement in the new host culture, de-emphasizing their own culture.[12,61–64] Proxy measures are often used in this unidimensional model.[13] More recently, a bilinear model of acculturation has been proposed. This model assumes a monocultural–bicultural continuum where individuals can endorse the values and

beliefs of both their native and host culture simultaneously.[64–68] One such scale measures involvement in the native and host culture separately, allowing for four types of adaptation: traditional, integrated, assimilated, and marginal.[69] Instruments created to reflect this multidimensional and multidirectional view of acculturation measure various dimensions including changes in behaviors, attitudes, norms and values as well as language preferences. [13,70,71] However, these multidimensional scales are not without criticism, including the inherent assumption that there is a well-defined mainstream culture and ethnic culture, and that cultural contact is occurring between two historically distinct groups.[72] Future population-based studies of Hispanics would generate more-useful results if they include theory-based, multidimensional acculturation scales, or measures of change in attitudes, behaviors, and beliefs over time with adaptation to a new culture.

According to 2000 Census data, one of every five children in the U.S is from an immigrant family where one or both parents is foreign-born.[73] This reality advocates the need for further study on the health of immigrant families and their children. Future interventions which target Hispanic children and their parents should take into account the child's generation status and language use at home, as these factors appear to play a role in activity levels and relative weight.

Acknowledgments

References

1. Bates LM, Acevedo-Garcia D, Alegria M, Krieger N. Immigration and generational trends in body mass index and obesity in the U.S.: results of the National Latino and Asian American Survey, 2002–2003. Am J Public Health 2008;98(1):70–77. [PubMed: 18048787]

2. Campbell PR. Population Projections for States by Age, Sex, Race, and Hispanic Origin: 1995 to 2025. U.S. Bureau of the Census, Population Division. 1996 PPL-47.

3. Crespo NC, Ball GDC, Shaibi GQ, Cruz ML, Weigensberg MJ, Goran MI. Acculturation is associated with higher VO2max in overweight Hispanic children. Pediatr Exerc Sci 2006;18(1):89–100.

4. Morales LS, Lara M, Kington RS, Valdez RO, Escarce JJ. Socioeconomic, cultural, and behavioral factors affecting Hispanic health outcomes. J Health Care Poor Underserved 2002;13(4):477–503. [PubMed: 12407964]

5. Feinstein JS. The relationship between socioeconomic status and health: A review of the literature. Milbank Q 1993;71(2):279–322. [PubMed: 8510603]

6. Singh GK, Siahpush M. All-cause and cause-specific mortality of immigrants and native born in the U.S. Am J Public Health Mar 2001;91(3):392–399.

7. Singh GK, Siahpush M. Ethnic-immigrant differentials in health behaviors, morbidity, and cause-specific mortality in the U.S.: An analysis of two national databases. Human Biology 2002 Feb;74(1): 83–109.

8. Hummer RA, Rogers RG, Nam CB, LeClere FB. Race/ethnicity, nativity and U.S. adult mortality. Soc Sci Q 1999;80:136–153.

9. Vega WA, Amaro H. Latino Outlook—Good Health, Uncertain Prognosis. Annu Rev Public Health 1994;15:39–67. [PubMed: 8054092]

10. Singh GK, Siahpush M. Ethnic-immigrant differentials in health behaviors, morbidity, and cause-specific mortality in the U.S.: An analysis of two national databases. Hum Biol 2002;74(1):83–109. [PubMed: 11931581]

11. Abraído-Lanza, AF.; White, K.; Vásquez, E. Immigrant populations and health. In: Anderson, N., editor. Encyclopedia of health and behavior. Newbury Park, CA: Sage; 2004. p. 533-537.

12. Perez-Escamilla R, Putnik P. The role of acculturation in nutrition, lifestyle, and incidence of type 2 diabetes among Latinos. J Nutr 2007;137(4):860–870. [PubMed: 17374645]

13. Abraído-Lanza AF, Armbrister AN, Florez KR, Aguirre AN. Toward a theory-driven model of acculturation in public health research. Am J Public Health 2006;96(8):1342–1346. [PubMed: 16809597]

14. Crespo CJ, Smit E, Carter-Pokras O, Andersen R. Acculturation and leisure-time physical inactivity in Mexican American adults: results from NHANES III, 1988–1994. Am J Public Health 2001;91 (8):1254–1257. [PubMed: 11499114]

15. Evenson KR, Sarmiento OL, Ayala GX. Acculturation and physical activity among North Carolina Latina immigrants. Soc Sci Med 2004;59(12):2509–2522. [PubMed: 15474205]

16. Fitzgerald N, Himmelgreen D, Damio G, Segura-Perez S, Peng YK, Perez-Escamilla R. Acculturation, socioeconomic status, obesity and lifestyle factors among low-income Puerto Rican women in Connecticut, U.S., 1998–1999. Pan Am J Public Health 2006;19(5):306–313.

17. Ham SA, Yore MM, Kruger J, Heath GW, Moeti R. Physical activity patterns among Latinos in the U.S.: putting the pieces together. Prev Chronic Dis 2007;4(4):A92. [PubMed: 17875267]

18. Slattery ML, Sweeney C, Edwards S, et al. Physical activity patterns and obesity in Hispanic and non-Hispanic white women. Med Sci Sports Exerc 2006;38(1):33–41. [PubMed: 16394951]

19. Wolin KY, Colditz G, Stoddard AM, Emmons KM, Sorensen G. Acculturation and physical activity in a working class multiethnic population. Prev Med 2006;42(4):266–272. [PubMed: 16481031]

20. Zsembik BA, Fennell D. Ethnic variation in health and the determinants of health among Latinos. Soc Sci Med 2005;61(1):53–63. [PubMed: 15847961]

21. Esparza J, Fox C, Harper IT, et al. Daily energy expenditure in Mexican and U.S. Pima Indians: low physical activity as a possible cause of obesity. Int J Obes Relat Metab Disord 2000;24(1):55–59. [PubMed: 10702751]

22. Stern MP, Gonzalez C, Mitchell BD, Villalpando E, Haffner SM, Hazuda HP. Genetic and environmental determinants of type II diabetes in Mexico City and San Antonio. Diabetes 1992;41 (4):484–492. [PubMed: 1607073]

23. Lara M, Gamboa C, Kahramanian MI, Morales LS, Bautista DEH. Acculturation and Latino health in the U.S.: A review of the literature and its sociopolitical context. Annu Rev Publ Health 2005;26:367–397.

24. Ahn MK, Juon HS, Gittelsohn J. Association of race/ethnicity, socioeconomic status, acculturation, and environmental factors with risk of overweight among adolescents in California, 2008. Prev Chronic Dis 2008;5(3):A75. [PubMed: 18558025]

25. Allen ML, Elliott MN, Morales LS, Diamant AL, Hambarsoomian K, Schuster MA. Adolescent participation in preventive health behaviors, physical activity, and nutrition: differences across immigrant generations for Asians and Latinos compared with whites. Am J Public Health 2007;97 (2):337–343. [PubMed: 17138919]

26. Elder JP, Broyles SL, Brennan JJ, Zuniga de Nuncio ML, Nader PR. Acculturation, parent—child acculturation differential, and chronic disease risk factors in a Mexican-American population. J Immigr Health 2005;7(1):1–9. [PubMed: 15744472]

27. Gordon-Larsen P, Harris KM, Ward DS, Popkin BM. Acculturation and overweight-related behaviors among Hispanic immigrants to the U.S.: the National Longitudinal Study of Adolescent Health. Soc Sci Med 2003;57(11):2023–2034. [PubMed: 14512234]

28. Gowen LK, Hayward C, Killen JD, Robinson TN, Taylor CB. Acculturation and eating disorder symptoms in adolescent girls. J Res Adolescence 1999;9(1):67–83.

29. Popkin BM, Udry JR. Adolescent obesity increases significantly in second and third generation U.S. immigrants: the National Longitudinal Study of Adolescent Health. J Nutr 1998;128(4):701–706. [PubMed: 9521631]

30. Singh GK, Yu SM, Siahpush M, Kogan MD. High levels of physical inactivity and sedentary behaviors among U.S. immigrant children and adolescents. Arch Pediatr Adolesc Med 2008;162(8): 756–763. [PubMed: 18678808]

31. 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):467–481. [PubMed: 15587346]

32. Carvajal SC, Hanson CE, Romero AJ, Coyle KK. Behavioural risk factors and protective factors in adolescents: a comparison of Latinos and non-Latino whites. Ethn Health 2002;7(3):181–193. [PubMed: 12523944]

33. Liu J, Probst JC, Harun N, Bennett KJ, Torres ME. Acculturation, physical activity, and obesity among Hispanic adolescents. Ethn Health 2009:1–17.

34. Blumberg SJ, Olson L, Frankel M, Osborn L, Srinath KP, Giambo P. Design and operation of the National Survey of Children's Health, 2003. Vital Health Stat 2005;1(43):1–124.

35. Kogan MD, Newacheck PW. Introduction to the volume on articles from the National Survey of Children's Health. Pediatrics 2007;119:S1–S3.

36. Immigrant children and their families: Issues for research and policy. Future Child 1995;5(2):72–89. [PubMed: 8528689]

37. Kuczmarski RJ, Ogden CL, Guo SS, Grummer-Strawn LM, Flegal KM, Mei Z, et al. CDC Growth Charts for the U.S.: methods and development. Vital Health Stat 2002;11(246):1–190. 2000.

38. Barlow SE. Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: Summary report. Pediatrics 2007;120:S164–S192. [PubMed: 18055651]

39. Physical Activity Guidelines Advisory Committee. Physical Activity Guidelines Advisory Committee Report, 2008. Washington, DC: USDHHS; 2008.

40. American Academy of Pediatrics. Committee on Public Education. American Academy of Pediatrics: Children, adolescents, and television. Pediatrics 2001;107:423–426. [PubMed: 11158483]

41. Blumberg SJ, Olson L, Frankel MR, Osborn L, Srinath KP, Giambo P. Design and Operation of the National Survey of Children's Health, 2003. National Center for Health Statistics. Vital Health Stat 2005;1(43)

42. Kumanyika S, Grier S. Targeting interventions for ethnic minority and low-income populations. Future Child 2006;16(1):187–207. [PubMed: 16532664]

43. Ogden CL, Carroll MD, Curtin LR, McDowell MA, Tabak CJ, Flegal KM. Prevalence of overweight and obesity in the U.S., 1999–2004. JAMA 2006;295(13):1549–1555. [PubMed: 16595758]

44. Hu WT, Foley TA, Wilcox RA, Kozera RM, Morgenstern BZ, Juhn YJ. Childhood obesity among Head Start enrollees in southeastern Minnesota: Prevalence and risk factors. Ethn Dis 2007;17(1): 23–28. [PubMed: 17274205]

45. Nelson JA, Chiasson MA, Ford V. Childhood overweight in a New York City WIC population. Am J Public Health 2004 Mar;94(3):458–462. [PubMed: 14998814]

46. Marín, G.; Marín, BV. Research with Hispanics. Newbury Park, CA: Sage; 1991.

47. Himmelgreen DA, Perez-Escamilla R, Martinez D, et al. The longer you stay, the bigger you get: length of time and language use in the U.S. are associated with obesity in Puerto Rican women. Am J Phys Anthropol 2004;125(1):90–96. [PubMed: 15293335]

48. Perez-Escamilla R, Himmelgreen D, Bonello H, et al. Nutrition knowledge, attitudes, and behaviors among Latinos in the U.S.: Influence of language. Ecol Food Nutr 2001;40(4):321–345.

49. Sundquist J, Winkleby M. Country of birth, acculturation status and abdominal obesity in a national sample of Mexican-American women and men. Int J Epidemiol 2000;29(3):470–477. [PubMed: 10869319]

50. Himmelgreen D, Daza NR, Cooper E, Martinez D. "I don't make the soups anymore": Pre- to post-migration dietary and lifestyle changes among Latinos living in West-Central Florida. Ecol Food Nutr 2007;46:427–444.

51. Pinzon-Perez H, Soto T. Viewing patterns of television advertisements among rural Latino working mothers: Implications of childhood overweight prevention. Hisp Health Care Int 2006;4(4):211–218.

52. Sallis JF. Self-report measures of children's physical activity. J Sch Health 1991;61(5):215–219. [PubMed: 1943046]

53. Welk GJ, Corbin CB, Dale D. Measurement issues in the assessment of physical activity in children. Res Q Exerc Sport 2000;71(2):S59–S73. [PubMed: 10925827]

54. Brandon P. The health risk behaviours and social connectedness of adolescents in immigrant families: Evidence from Australia. Int Migration 2008;46(2):49–80.

55. Yu SM, Huang ZHJ, Schwalberg RH, Kogan MD. Parental awareness of health and community resources among immigrant families. Matern Child Health J 2005;9(1):27–34. [PubMed: 15880972]

56. Springer AE, Lewis K, Kelder SH, Fernandez ME, Barroso CS, Hoelscher DM. Physical Activity Participation by Parental Language Use in 4th, 8th, and 11th Grade Students in Texas, U.S. J Immigr Minor Health. 2009 in press.

57. Goel MS, McCarthy EP, Phillips RS, Wee CC. Obesity among U.S. immigrant subgroups by duration of residence. JAMA 2004;292(23):2860–2867. [PubMed: 15598917]

58. Delva J, O'Malley PM, Johnston LD. Health-related behaviors and overweight: a study of Latino adolescents in the U.S. Pan Am J Public Health 2007;21(1):11–20.

59. Thomson MD, Hoffman-Goetz L. Defining and measuring acculturation: A systematic review of public health studies with Hispanic populations in the U.S. Soc Sci Med. 2009 in press.

60. Cuellar I, Arnold B, Maldonado R. Acculturation rating scale for Mexican-Americans-II: A revision of the original ARSMA scale. Hisp J Behav Sci 1995;17(3):275–304.

61. Hazuda HP, Sterm MP, Haffner SM. Acculturation and assimilation among Mexican-Americans: Scales and population-based data. Soc Sci Q 1988;69(3):687–706.

62. Park RE. Human Migration and the marginal man. Am J Sociol 1928;33:881–893.

63. Franco JN. An acculturation scale for Mexican-American children. J Gen Psychol 1983;108(2):175–181.

64. Nguyen HH, von Eye A. The Acculturation Scale for Vietnamese Adolescents (ASVA): A bidimensional perspective. Int J Behav Dev 2002;26(3):202–213.

65. Berry J, Kim U, Power S, Young M, Bujaki M. Acculturation attitudes in plural societies. Appl Psychol Int Rev 1989;38:185–206.

66. Dona G, Berry J. Acculturation attitudes and acculturative stress of Central American refugees. Int J Psychol 1994;29:57–70.

67. Phinney JS. Ethnic identity in adolescents and adults: review of research. Psychol Bull 1990;108(3): 499–514. [PubMed: 2270238]

68. Beck CT. Acculturation: implications for perinatal research. MCN Am J Matern Child Nurs 2006;31 (2):114–120. [PubMed: 16523037]

69. Berry, JW. Conceptual approaches to acculturation. In: Chun, KM.; Organista, PB.; Marin, G., editors. Acculturation: Advances in theory, measurement and applied research. Washington, DC: APA; 2003.

70. Cuéllar I, Arnold B, González G. Cognitive referents of acculturation: Assessment of cultural constructs in Mexican Americans. J Comm Psychol 1995;23(4):339–356.

71. Zane, N.; Mak, W. Major approaches to the measurement of acculturation among ethnic minority populations: A content analysis and alternative empirical strategy. In: Chun, KM.; Balls-Organista, P.; Marin, G., editors. Acculturation: Advances in theory, measurement and applied research. Washington, DC: APA; 2003. p. 39-60.

72. Hunt LM, Schneider S, Comer B. Should "acculturation" be a variable in health research? A critical review of research on U.S. Hispanics. Soc Sci Med 2004;59(5):973–986. [PubMed: 15186898]

73. Hernandez DJ. Demographic change and the life circumstances of immigrant families. Future Child 2004;14(2):17–47.

Table 1

Classification of sample participants into generation/language groups by country of birth and primary language

| Groups | n | Country of birth | | | Primary language |
		Mother	Father	Child	
1st generation, non-English	141	F	F	F	NoE
1st generation, English	10	F	F	F	E
2nd generation, non-English	365	F	F	U.S.	NoE
2nd generation, English	113	F	F	U.S.	E
3rd generation, non-English	78	At least one parent U.S.	At least one parent U.S.	U.S.	NoE
3rd generation, English	1315	At least one parent U.S.	At least one parent U.S.	U.S.	E

Note: Children were categorized according to generational status (i.e., parent and child place of birth) and primary language spoken in the home (i.e., English, non-English).

E, English speaking; F, foreign born; NoE, non-English speaking; U.S., born in the U.S.

Table 2

Weighted sample descriptives of children by generation and language groups[a]

			Generation/language groups			
	1st gen., non-English n = 141	2nd gen., non-English n = 365	2nd gen., English n = 113	3rd gen., non-English n = 78	3rd gen., English n = 1,315	All n = 2012
Age, year, M (SE)	9.1 (0.2)	8.7 (0.1)	9.1 (0.3)	8.2 (0.3)	8.6 (0.1)	8.7 (0.1)
Gender (%)						
Men	49.0	49.2	39.7	31.0	53.2	50.0
Women	51.0	50.8	60.3	69.0	46.8	50.0
Weight status[b]						
BMI z-score, M (SE)	1.64 (0.14)	1.53 (0.09)	1.07 (0.20)	1.09 (0.24)	1.10 (0.06)	1.26 (0.05)
Normal weight (%)	27.1	28.4	49.3	41.5	49.7	41.7
Overweight (%)	16.2	21.4	15.6	27.5	17.5	18.8
Obese (%)	56.7	50.2	35.2	31.1	32.8	39.5
Screen time[c], **M (SE), hrs/day**	1.40 (0.11)	1.64 (0.08)	1.67 (0.14)	1.55 (0.14)	1.90 (0.12)	1.76 (0.07)
> 2 hrs/day (%)	11.9	14.8	16.3	6.7	20.5	17.4
Physical activity[d], **M (SE), days/wk**	3.33 (0.37)	3.93 (0.19)	4.34 (0.32)	4.11 (0.42)	4.31 (0.12)	4.12 (0.10)
No physical activity[e] (%)	18.1	12.6	3.1	12.5	7.8	10.0
Regular physical activity[f] (%)	39.4	53.2	59.9	51.5	62.2	57.1
Sports participation[g] (%)	23.1	34.3	44.3	40.8	59.4	47.9
Club participation[h] (%)	21.9	21.9	56.0	27.0	47.3	38.0
Household Income[i] **(%)**						
Poor	84.7	63.8	38.3	42.7	23.9	46.7
Near poor	9.1	16.8	16.0	24.4	8.5	11.9
Not poor	6.2	19.4	45.7	33.0	67.5	41.3
Household education[j] **(%)**						
<12 years	26.3	38.8	12.3	20.8	4.3	16.5
12 years	42.8	37.7	38.2	47.1	29.3	34.0
>12 years	30.9	23.5	49.6	32.2	66.4	49.6

[a] Children were categorized according to generational status (1st, 2nd, or 3rd) and primary language spoken in the home (English or non-English).

[b] Normal weight is defined as having a BMI above the 5th percentile but below the 85th percentile; overweight at or above the 85th percentile; and, obese at or above the 95th percentile.

[c] Screen time includes TV, videos, and video games.

[d] Physical activity was measured in days per week and defined as exercising or participating in a physical activity $\geq$20 minutes that made the child breathe hard and sweat.

[e] No physical activity is defined as exercising or participating in physical activity 0 days per week.

[f] Regular physical activity is defined as participating in $\geq$3 days of exercise or physical activity per week.

[g] Sports participation is defined as belonging to a sports team or taking part in sports lessons in the past 12 months.

[h] Club participation is defined as participating in any clubs or organizations in the past 12 months.

[i] Income was grouped into 3 categories based on USDHHS Federal Poverty Guidelines for households: "poor", below 133% poverty; "near poor", at or above 133% poverty but below 185% poverty; and, "not poor", at or above 185% poverty.

[j] Highest level of education in the household.

Gen., generation;

Table 3

AORs of dependent variables by generation status and language.[a]

	Generation/Language Groups				
	1st Generation, non-English n=141	2nd Generation, non-English n=365	2nd Generation, English n=113	3rd Generation, non-English n=78	3rd Generation, English n=1315
Weight Status[b]					
Overweight	1.61 (0.65, 3.95)	2.81 (1.02, 3.19)*	0.84 (0.38, 1.89)	1.69 (0.70, 4.09)	1.00
Obese	2.75 (1.35, 5.62)**	2.16 (1.32, 3.53)**	1.02 (0.51, 2.03)	1.06 (0.37, 3.02)	1.00
Screen time[c]					
>2 hours/day	0.40 (0.18, 0.91)*	0.53 (0.31, 0.92)*	0.71 (0.32, 1.58)	0.24 (0.08, 0.70)**	1.00
Regular physical activity[d]	0.49 (0.25, 0.96)*	0.85 (0.54, 1.33)	0.98 (.52, 1.87)	0.79 (0.36, 1.76)	1.00
Sport Participation[e]	0.44 (0.23, 0.86)*	0.86 (0.54, 1.37)	0.79 (0.41, 1.54)	1.04 (0.48, 2.27)	1.00
Club Participation[f]	0.43 (0.20, 0.96)*	0.44 (0.27, 0.72)**	1.66 (0.83, 3.30)	0.55 (0.23, 1.31)	1.00

Note: Regression analyses were adjusted for child age and gender, household income and highest education level; The comparison group was 3rd gen., English speakers; numbers in parentheses represent the 95% CI.

[a] Children were categorized according to generational status (i.e., 1st, 2nd, 3rd) and primary language spoken in the home (i.e., English or non-English).

[b] Normal weight is defined as having a BMI above the 5th percentile but below the 85th percentile, overweight at or above the 85th percentile, and, obese at or above the 95th percentile. Reference category is normal weight.

[c] Screen time includes TV, videos, and video games. Reference category is ≤2 hours of screen time.

[d] Regular physical activity is defined as participating in ≥3 days/week of exercise or vigorous physical activity. Reference category is <3 days/week of vigorous physical activity.

[e] Sports participation is defined as belonging to a sports team or taking part in sports lessons in the past 12 months. Reference category is no sports participation.

[f] Club participation is defined as participating in any clubs or organizations in the past 12 months. Reference category is no club participation.

* p<.05;

** p<.01.