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Longitudinal changes in physical activity and sedentary behavior from adolescence to adulthood: comparing U.S.-born and foreign-born populations

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Abstract

Background—This study compared moderate-to-vigorous physical activity (MVPA) and sedentary behavior in U.S.-born and foreign-born adolescents and young adults, and differences in behavior change from adolescence to young adulthood by nativity.

Methods—Data on 2,039 U.S.-born and 225 foreign-born participants from Project EAT-III (Eating and Activity in Teens and Young Adults) was used to examine MVPA, television/DVD/video viewing, and computer use. Participants completed surveys at baseline in Minneapolis/St. Paul, Minnesota secondary school classrooms in 1998–1999 (14.9 ± 1.6 y) and follow-up measures online or by mail in 2008–2009 (25.3 ± 1.6 y).

Results—At both time points, foreign-born participants reported significantly lower levels of MVPA than their U.S.-born counterparts ($p < 0.05$). Foreign-born females at baseline and follow-up and foreign-born males at follow-up reported less television/DVD/video viewing compared with U.S.-born participants ($p < 0.01$). All participants experienced a significant decline in MVPA from baseline to follow-up ($p < 0.001$). Between-group analyses revealed a significantly greater decline in television/DVDs/video viewing for the foreign-born males compared with U.S.-born males from baseline to follow-up (mean change: foreign-born: -4.8 ± 1.32 hrs/wk, U.S.-born: -0.6 ± 0.6 hrs/wk; $p < 0.01$).

Conclusions—Differences in activity patterns between foreign-born and U.S.-born youth into young adulthood may contribute to disparities in chronic disease risk. Nativity, along with the social, environmental, and cultural context, should be considered when designing programs to promote MVPA and prevent obesity.

Keywords

immigrant; physical activity; gender; youth; adolescent; longitudinal

INTRODUCTION

Only 18.4% of adolescents are meeting national guidelines to engage in at least 60 minutes of physical activity each day.¹ In addition, these already low physical activity rates tend to decline into young adulthood.² The inactivity of our nation's youth is concerning given that behavioral patterns formed during childhood and adolescence can carry over into adulthood.³ Interventions to increase physical activity and prevent obesity in U.S. youth are a great public health need of the 21st century.

The U.S. immigrant population is growing at a rapid rate; in 2010, approximately 13% of the U.S. population was foreign-born.⁴ There is evidence that immigrants tend to have better health and mortality outcomes than their U.S.-born counterparts.^{5–8} However, this health advantage experienced by immigrants often declines with increased length of time living in the U.S.^{9–13} As the U.S. immigrant population increases, there is a need to better understand both the similarities and differences in health-related behaviors between foreign-born and U.S.-born groups and longitudinal changes in behaviors during major developmental transitional periods. It is important to study immigrants' health-related behaviors because of the increasing influence they will have on the overall public health of the nation.

Previous studies with immigrant children, adolescents, and adults have shown that immigrants have lower levels of physical activity compared with those who are U.S.-born.^{14–23} However, many of these same studies have also demonstrated that physical activity levels tend to increase the longer immigrants live in the U.S. Moderate-to-vigorous physical activity (MVPA) has been associated with better cardiometabolic risk factors in children and adults.^{24, 25} To the best of our knowledge, no studies have compared longitudinal changes in MVPA of foreign-born and U.S.-born males and females in adolescence and young adulthood. Further, while there is evidence that physical activity markedly declines from childhood to adulthood for U.S. youth,^{26–31} it is unclear whether activity levels similarly decrease among foreign-born youth.

As physical activity declines over time, there is evidence that sedentary behavior increases, beginning in childhood and continuing through adolescence.^{29, 31, 32} Television viewing, the most common measure of sedentary behavior, has been associated with poorer physical fitness and psychosocial health, and increased risk of obesity in youth.^{33, 34} However, other forms of sedentary behavior (e.g., computer use) may influence health differently, depending on the context and whether a prolonged amount of time is spent sitting. Previous studies with foreign-born and non-English speaking children and adolescents are inconclusive as to whether immigrant and U.S.-born youth differ in their patterns of sedentary behavior.^{18–20, 35} Further, there is a lack of understanding surrounding longitudinal changes in sedentary behaviors in foreign-born populations.

To our knowledge, this is the first study to examine and compare longitudinal trends in physical activity and sedentary behavior in foreign-born and U.S.-born youth. Information yielded from this study will provide insight into how immigrant youths' activity patterns, and changes in those patterns from adolescence to young adulthood, differ from those of U.S.-born youth. Such information will provide a greater understanding of the needs of foreign-born young people living in the U.S. In addition, this information will be valuable to informing effective interventions to promote physical activity in both U.S.-born and foreign-born populations. The aims of the present study are two-fold: (1) to determine whether levels of physical activity and sedentary behavior differ between foreign-born and U.S.-born participants at baseline (adolescence) and follow-up (young adulthood), and (2) to examine longitudinal changes in physical activity and sedentary behavior both within and between foreign-born and U.S.-born groups.

METHODS

Study Design and Population

Data were drawn from Project EAT (Eating and Activity in Teens and Young Adults)-III, the third wave of a 10-year longitudinal study that examined eating, physical activity, and weight-related variables among young people. In Project EAT-I (1998–1999), middle school and high school students from the Minneapolis/St. Paul metropolitan area of Minnesota completed surveys and anthropometric measures in school.^{36, 37} Project EAT-III was designed to follow up on the original participants in 2008–2009 as they progressed from adolescence to young adulthood and through their twenties.³⁸ Participants were mailed letters inviting them to complete online or paper versions of the Project EAT-III survey and were offered 50 dollars for survey completion. Complete follow-up survey data were collected from 2,287 young adults, representing 66.4% of those for whom contact information was available and 48.2% of the original cohort. The Institutional Review Board Human Subjects Committee at the University of Minnesota approved all study protocols.

Because 23 participants were missing data on nativity, the final sample for the current analysis included 2,264 participants ($n = 1,018$ males, $n = 1,246$ females). Participants had a mean age of 14.9 ± 1.6 years at baseline and a mean age of 25.3 ± 1.6 years at follow-up. A total of 2,039 participants reported they were born in the U.S., while 225 participants were foreign-born. Sociodemographic characteristics of the U.S.-born and foreign-born participants are presented in Table 1. Foreign-born adolescents were significantly more likely to have a low or low-middle SES ($p < 0.001$) and be non-white ($p < 0.001$) compared with U.S.-born adolescents.

Survey Development and Measures

The Project EAT-I survey was developed based on adolescent focus groups,³⁹ an extensive literature review, content reviews by multi-disciplinary experts and adolescents, and pilot tests. To allow for longitudinal comparisons, measures of key variables were similar at both time points; however, some measures were modified to be more age-appropriate (e.g., computer use) or more appropriate given advances in technology (e.g., DVD versus video viewing). Test-retest reliability of the measures over a 2-week period was assessed at baseline in a diverse sample of 161 adolescents.³⁶

Physical Activity—Leisure-time physical activity was assessed at baseline and follow-up by asking, “In a usual week, how many hours do you spend doing the following activities?” Participants were then asked to report the number of hours they engaged in any strenuous exercise (e.g., biking fast, jogging, basketball, etc.), moderate exercise (e.g., walking quickly, skiing, dancing, skateboarding, etc.), and mild exercise (e.g., walking slowly, fishing, snowmobiling, etc.). Response options ranged from 0 to 6 hours per week. Questions were adapted from the Leisure Time Exercise Questionnaire,⁴⁰ a well-established measure significantly correlated with other measures of physical activity in children and adolescents.⁴¹ Test-retest correlations were $r = 0.63$ (strenuous), $r = 0.52$ (moderate), and $r = 0.51$ (mild); these reliability estimates are consistent with those cited in previous studies that have measured self-reported physical activity among adolescents and young adults.^{40, 42} MVPA was calculated by summing the hours-per-week spent in strenuous and moderate exercise, only.

Sedentary Behavior—Sedentary behavior was estimated at baseline and follow-up using questions adapted from a previous study.⁴³ Participants were asked to report separately the number of hours on an average weekday and weekend day they spent: (1) watching TV/DVDs/videos, and (2) using a computer. Response options ranged from 0 to 5 hours. Test-

retest correlations were $r=0.80$ for weekday television/DVD/video viewing, $r=0.69$ for weekend television/DVD/video viewing, $r=0.66$ for weekday computer use, and $r=0.71$ for weekend computer use. The item to assess leisure-time computer use was worded differently at baseline (using a computer [not for homework]) than at follow-up (using a computer [not for work or school]) to reflect developmental differences in computer use.

Sociodemographics—Participants reported their gender, age, race/ethnicity, nativity, socioeconomic status (SES), and weight status. Participants' nativity status was assessed at baseline by asking whether they were born in the United States (Test-retest Kappa=0.93). SES was based primarily on the highest level of parental education reported at baseline.³⁷ Height and weight was self-reported by participants at baseline and follow-up, and BMI was calculated using the standard formula (body weight [kg] / height [m]²). The Centers for Disease Control and Prevention cutpoints were used to categorize participants as non-overweight or overweight.^{44, 45}

Statistical Analyses

Proportions and means were calculated for the sociodemographic variables; differences in sociodemographics by nativity were assessed using chi-square tests. Because levels of physical activity and sedentary behavior differ between males and females,^{46, 47} all other analyses were conducted separately for each gender. For examining differences between U.S.-born and foreign-born youth, separate analyses of co-variance (ANCOVA) were run on the EAT-I (baseline) and EAT-III (follow-up) datasets. Model 1 was run separately for each outcome variable (i.e., MVPA, television/DVD/video viewing, and computer use) while adjusting for the covariates (i.e., age, race/ethnicity, and SES). Model 2 was run separately for each outcome variable and included adjustment for covariates in addition to the outcome measure at baseline.

To examine longitudinal change within U.S.-born and foreign-born groups, mixed model ANOVAs were run for each outcome variable including a main effect term for time (EAT-I versus EAT-III) and a random effect term for individuals. To examine differences in longitudinal change between groups, 10-year change from EAT-I to EAT-III was calculated for each participant for each outcome using ANCOVA with adjustment for age, race/ethnicity, and SES.

Because attrition from the EAT-I sample did not occur at random, in all analyses, the data were weighted by the inverse response propensity method.⁴⁸ When compared to nonrespondents at Project EAT-III, respondents were more likely to be female, white, younger in age, and of higher SES. Response propensities (i.e., the probability of responding to the Project EAT-III survey) were estimated using a logistic regression of response at EAT-III on a large number of predictor variables from the Project EAT-I survey. Weights were additionally calibrated so that the weighted total sample sizes used in analyses accurately reflect the actual observed sample sizes for males and females. The weighting method resulted in estimates representative of the demographic make-up of the original school-based sample, thereby allowing results to be more fully generalizable to the population of young people in the Minneapolis/St. Paul metropolitan area. All analyses were completed using SAS 9.2 software (SAS Institute, Cary, NC). Statistical significance was set at $p<0.05$ (two-sided).

RESULTS

Physical activity and sedentary behavior by nativity

Physical Activity—Adjusted means and standard errors (controlling for age, race/ethnicity, and SES) for physical activity and sedentary behavior by nativity are presented in Tables 2 (males) and 3 (females). At baseline (adolescence) and follow-up (young adulthood), foreign-born males reported significantly lower levels of MVPA compared with U.S.-born males (Table 2, **Model 1**). For example, as young adults, foreign-born males engaged in 3.4 ± 0.36 hours of physical activity per week, while U.S.-born males engaged in 5.3 ± 0.16 hours per week ($p < 0.001$). These differences remained statistically significant in young adulthood when controlling for baseline levels of MVPA (Table 2, **Model 2**); that is preexisting differences in MVPA at baseline did not explain the differences exhibited in MVPA between the foreign-born and U.S.-born males at follow-up.

Foreign-born females also reported significantly lower levels of MVPA in adolescence and young adulthood compared with U.S.-born females (all p 's < 0.05 ; Table 3, **Model 1**). These differences in MVPA at follow-up were no longer statistically significant when controlling for baseline behaviors (Table 3, **Model 2**).

Sedentary Behavior—Foreign-born males reported more hours of computer use per week (12.1 ± 1.04 hours) than U.S.-born males (9.3 ± 0.46 hours; $p < 0.05$) in adolescence (Table 2, **Model 1**). While adolescent foreign-born and U.S.-born males did not differ in reported hours per week of television/DVD/video viewing, foreign-born males in young adulthood reported fewer hours of television/DVD/video viewing per week compared to the U.S.-born males ($p < 0.01$; Table 2, **Model 1**); this difference remained after controlling for baseline levels of television/DVD/video viewing (Table 2, **Model 2**). Foreign-born males did not significantly differ from the U.S.-born males in hours per week of computer use in young adulthood.

Adolescent foreign-born females reported fewer hours of television/DVD/video viewing per week compared to the adolescent U.S.-born females ($p < 0.01$; Table 3, **Model 1**). Foreign-born females also reported fewer hours of television/DVD/video viewing per week (16.8 ± 0.94 hours) than U.S.-born females (20.3 ± 0.38 hours) in young adulthood ($p < 0.001$); this difference remained after controlling for baseline levels of television/DVD/video viewing ($p < 0.05$; Table 3, **Model 2**).

Longitudinal changes in physical activity and sedentary behavior

Within-group change—Within-group change in MVPA was significant in all groups (results not shown in tables); that is, both foreign-born and U.S.-born males and females experienced a significant decline in MVPA from adolescence to young adulthood (all p 's < 0.001). Additionally, all groups experienced a significant increase in computer use from adolescence to young adulthood (all p 's < 0.001). Foreign-born males experienced a significant decline in television/DVD/video viewing ($p < 0.05$) while U.S.-born females experienced a significant increase in television/DVD/video viewing ($p < 0.05$) from adolescence to young adulthood.

Between-group change—Between-group change (adjusted for age, race/ethnicity and SES) from baseline to follow-up is included in Table 2 (males) and Table 3 (females). Foreign-born and U.S.-born males did not differ in longitudinal changes in MVPA from adolescence to young adulthood. However, foreign-born males did experience a significantly greater decline in television/DVD/video viewing hours per week from adolescence to young adulthood compared with U.S.-born males (mean change-foreign-born

males: -4.8 ± 1.32 hours; U.S.-born males: -0.6 ± 0.58 hours; $p < 0.01$) (Table 2). There were no statistically significant differences between foreign-born and U.S.-born females in the models of change for MVPA, television/DVD/video viewing, or computer use from adolescence to young adulthood.

DISCUSSION

To our knowledge, this is the first study to examine longitudinal trends in physical activity and sedentary behavior comparing foreign-born and U.S.-born adolescents and young adults. Foreign-born participants had lower levels of MVPA than their U.S.-born counterparts. Results were more mixed regarding differences between foreign-born and U.S.-born participants in levels of television/DVD/video viewing and computer use. Both foreign-born participants and U.S.-born participants experienced a significant decline in MVPA in the 10 year period from baseline to follow-up. Results revealed that foreign-born males experienced a significantly greater decline in television/DVDs/video viewing than the U.S.-born males over the 10 year period.

Physical Activity

Corroborating previous studies, foreign-born males and females in adolescence and young adulthood reported lower levels of physical activity than their U.S.-born counterparts.^{15–18, 49, 50} Further, both foreign-born and U.S.-born participants experienced a marked decline in physical activity from adolescence to young adulthood. This is the first study to demonstrate this longitudinal trend in physical activity in a foreign-born population; though, this is in line with previous studies looking at physical activity decline in U.S. adolescents and young adults.^{26–29, 31} It is unclear whether similar factors are at play for foreign-born youth versus U.S.-born youth that led to this decrease in physical activity from adolescence to young adulthood. Though beyond the scope of this study, the observed differences in physical activity between foreign-born and U.S.-born youth could be partly attributed to the influence of various cultural (e.g., cultural norms, language barriers), social (e.g., SES, social support), or environmental (e.g., access/availability, neighborhood safety) factors.^{19, 51–56} Future studies are needed to examine the correlates of physical activity, including facilitators and barriers, in foreign-born young people representing diverse racial/ethnic backgrounds.

There were lower levels of MVPA in foreign-born females compared with U.S.-born females in adolescence and young adulthood; however, the differences present at baseline for females explained the differences that existed at follow-up in our analyses. This can be interpreted as foreign-born young women had lower MVPA at follow-up because they started out with lower levels at baseline and experienced a decline similar to that experienced by the U.S.-born young women. It is possible that increasing home and work demands in young adulthood may have led the foreign-born and U.S.-born females to experience a stark decline in physical activity from adolescence to young adulthood. Such home and work demands, shown to be higher in immigrant females,^{57–59} could also explain the co-existing low levels of MVPA and leisure-time sedentary behaviors reported by foreign-born females. It is possible that these demands left little time for the foreign-born females to engage in any kind of leisure activity, whether sedentary or active in nature.

Sedentary Behavior

With the exception of foreign-born males during adolescence, foreign-born participants had significantly lower levels of television/DVD/video viewing than their U.S.-born counterparts. This finding corroborates evidence from previous research in children and adolescents.¹⁸ However, foreign-born and U.S.-born males in young adulthood and foreign-

born and U.S.-born females in adolescence and young adulthood did not differ in hours of computer use. Additionally, all participants regardless of nativity experienced a substantial increase in computer use over time. Because foreign-born youth may be less likely than U.S.-born youth to engage in some sedentary behaviors but not others, programs should target multiple forms of sedentary behavior in obesity prevention.

Adolescent foreign-born males reported approximately 3 more hours of computer use per week compared with U.S.-born males; further, while not statistically significant, foreign-born males also reported approximately 2 more hours of television/DVD/video viewing per week compared to U.S.-born males in adolescence. It is possible that factors not taken into account here, such as social isolation, language barriers, social discrimination, and neighborhood safety, may have led adolescent foreign-born males to spend more time at home in sedentary behaviors compared with U.S.-born males. Future studies should continue to assess the prevalence and correlates of various leisure-time sedentary behaviors in foreign-born and U.S.-born young people (including computer use, video/electronic games, reading, etc.), and their influence on health-related behaviors and outcomes.

Change in activity behaviors over time

While all groups experienced a decline in physical activity and an increase in computer use over 10 years, foreign-born males experienced a significantly greater decline in television/DVD/video viewing from adolescence to young adulthood than U.S.-born males. That is, television/DVD/video viewing for foreign-born males decreased by approximately 5 hours while viewing among U.S.-born males remained relatively stable over time. It is possible that foreign-born males replaced time spent in television/DVD/video viewing with other sedentary behaviors not assessed here (e.g., reading, school work), rather than with physical activities, given their level of MVPA declined over time. Also, foreign-born males may have fewer opportunities for leisure-time sedentary behaviors than U.S.-born males due to responsibilities at home or at work. More research is needed to explore reasons for these differences in longitudinal changes in sedentary behaviors between the foreign-born and U.S.-born males.

Study strengths and limitations

Study strengths and limitations should be considered in interpreting the findings. A major strength of this study was that it tracked a large, diverse longitudinal sample from adolescence to young adulthood. To our knowledge, this is the first large, epidemiologic study assessing changes in physical activity and sedentary behaviors in both foreign-born and U.S.-born adolescents and young adults. Along with these strengths, this study has limitations. Despite the sample being large and diverse, it was drawn from one geographic region in the Midwestern United States and nonresponse at EAT-III might have produced biases not fully corrected by the use of propensity weighting. However, nonresponse bias concerns were lessened by analyses comparing responders and nonresponders which showed response at EAT-III was not associated with MVPA, television/DVD/video viewing, or computer use at EAT-I in the weighted models.

The relatively small number of foreign-born participants may have affected the statistical power to detect differences between the groups. Due to limitations of the measures, a detailed description of the foreign-born participants was not possible; future studies should assess additional information (e.g., country of origin, length of time in the U.S., language use, etc.) to consider diversity within the foreign-born group. While the analyses were adjusted for SES, nativity is likely a proxy for other important variables that were not assessed in the present study and known to influence activity patterns (e.g., acculturation, length of time in the U.S., neighborhood environment, access/availability of resources,

social support, etc.).⁶⁰ Additional analyses were run comparing the variance explained in the models by nativity without adjustment for SES and variance explained by SES without adjustment for nativity; findings revealed that SES as measured in this study did not seem to be proxy for nativity.

Measures of physical activity and sedentary behavior were based on self-report. While Project EAT uses standardized 7-day recall survey items considered relevant and practical for epidemiologic studies,⁴¹ these self-reported measures may still contain biases and error. Also, the measure of physical activity did not capture other domains of physical activity, such as work- and transportation-related physical activity, which may be higher in some immigrant groups.^{61, 62} Further, the physical activities outlined in the survey may not have adequately represented popular activities among the foreign-born participants, possibly leading to an underestimate of their leisure-time activity levels.^{63, 64} Finally, due to the changes made to the sedentary behavior measure at follow-up, video/electronic game use may have been reported in the measure of computer use at baseline; however, it is unlikely that this difference in wording would have resulted in the large observed changes in computer use over time.

Conclusions

In sum, this study provides initial evidence of differences in physical activity and sedentary behavior by nativity during adolescence that continue into young adulthood. Lower levels of physical activity in foreign-born youth and higher levels of television/DVD/video viewing in U.S.-born youth into young adulthood may contribute to disparities in chronic disease risk. As such, it is important to understand patterns of behavioral change in these different subgroups of the population. Nativity, along with the social, environmental, and cultural context, should be taken into account when designing programs to prevent obesity and promote physical activity in these populations. For example, interventionists should integrate linguistically-tailored materials and culturally-appropriate forms of activity into the programs. Consideration of the target population's SES, country of origin, and associated cultural background may also help in increasing the relevance of interventions to the populations being served.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1Sociodemographic characteristics of the study sample (n=2,264) by nativity^a

Characteristic	Foreign-born (n=225) %	U.S.-born (n=2,039) %	p-value ^b
Gender, Female	52.6	55.7	0.260
Age at follow-up ^c			0.081
25y	34.2	29.7	
> 25y	65.8	70.3	
Race/ethnicity			<0.0001
White	5.7	57.6	
Black/African American	21.8	18.1	
Hispanic	12.9	4.3	
Asian	56.7	11.5	
Mixed/Other	2.9	8.5	
SES			<0.0001
Low	38.1	14.1	
Low-middle	13.7	19.9	
Middle	25.9	26.2	
Upper-middle	11.5	25.6	
High	10.8	14.2	
Overweight			
Baseline	22.9	26.8	0.130
Follow-up	49.0	52.1	0.295

^a All percentages are weighted to reflect the probability of responding to the EAT-III survey;^b P-values based on Chi-square tests; Bold-face type indicates significance at the p<0.05 level;^c Participants had a mean age of 14.9±1.6 years at baseline and a mean age of 25.3±1.6 years at follow-up;

Table 2

Males' physical activity and sedentary behavior by nativity: Levels during adolescence, levels during young adulthood, and changes over the 10-year study period (n=1,018).^a

	Baseline (Adolescence)			Follow-up (Young adulthood)			Adjusted Mean Change ^b (Baseline to Follow-up)		
	Foreign-born	U.S.-born	Model 1 p-value ^d	Foreign-born	U.S.-born	Model 1 p-value ^d	Foreign-born	U.S.-born	p-value ^f
	Mean (Standard Error) [M(SE)], ^c hrs/wk	M(SE), hrs/wk	Model 1 p-value ^d	Foreign-born	U.S.-born	Model 1 p-value ^d	Foreign-born	U.S.-born	
MVPA	6.7 (0.39)	7.6 (0.17)	0.033	3.4 (0.36)	5.3 (0.16)	< 0.001	-3.2 (0.49)	-2.3 (0.21)	0.102
Television/DVD/video	23.5 (1.03)	21.7 (0.45)	0.093	18.4 (1.00)	21.1 (0.43)	0.005	-4.8 (1.32)	-0.6 (0.58)	0.004
Computer use	12.1 (1.04)	9.3 (0.46)	0.014	16.0 (1.03)	15.4 (0.45)	0.521	3.9 (1.35)	6.3 (0.59)	0.112

Note: MVPA = moderate-to-vigorous physical activity; Bold-face type indicates significance at the $p < 0.05$ level;

^aObservations with missing values were excluded from the models resulting in slight variations in sample sizes between the models for each outcome variable of interest

^b Adjusted mean change is defined as the difference in the outcome measure from baseline to follow-up, controlling for the covariates (age, race/ethnicity, and socio-economic status [SES])

^c All means and standard errors are reported for the base model (Model 1) and were adjusted for covariates age, race/ethnicity, and SES.

d Model 1 included adjustment for covariates age, race/ethnicity and SES

² Model 2 included adjustment for covariates in addition to the outcome measure at baseline

^fRepresents between-group significance levels

Table 3

Females' physical activity and sedentary behavior by nativity: Levels during adolescence, levels during young adulthood, and changes over the 10-year study period (n=1,246).^a

	Baseline (Adolescence)		Follow-up (Young adulthood)			Adjusted Mean Change ^b (Baseline to Follow-up)	
	Foreign-born	U.S.-born		Foreign-born	U.S.-born	Foreign-born	U.S.-born
	Mean (Standard Error) [M (SE)], ^c hrs/wk	M(SE), hrs/wk	Model 1 p-value ^d	M(SE), hrs/wk	M(SE), hrs/wk	M(SE), hrs/wk	M(SE), hrs/wk
MVPA	4.6 (0.36)	5.9 (0.14)	<0.001	2.8 (0.26)	3.4 (0.11)	0.020	0.078
Television/DVD/video	16.4 (0.96)	19.8 (0.38)	0.001	16.8 (0.94)	20.3 (0.38)	<0.001	0.046
Computer use	6.5 (0.78)	7.1 (0.31)	0.589	11.9 (0.86)	11.6 (0.35)	0.331	0.357
						5.5 (1.11)	4.5 (0.44)
						0.7 (1.13)	0.4 (0.45)
						-1.8 (0.42)	-2.5 (0.17)
						0.117	0.778
						0.443	

Note: MVPA = moderate-to-vigorous physical activity; Bold-face type indicates significance at the p<0.05 level;

^a Observations with missing values were excluded from the models resulting in slight variations in sample sizes between the models for each outcome variable of interest

^b Adjusted mean change is defined as the difference in the outcome measure from baseline to follow-up, controlling for the covariates (age, race/ethnicity, and socio-economic status [SES])

^c All means and standard errors are reported for the base model (Model 1) and were adjusted for covariates age, race/ethnicity, and SES

^d Model 1 included adjustment for covariates age, race/ethnicity and SES

^e Model 2 included adjustment for covariates in addition to the outcome measure at baseline

^f Represents between-group significance levels