

## Physical Activity Differences by Birthplace and Sex in Youth of Mexican Heritage

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**Background:** One of the goals of *Healthy People 2020* is to increase physical activity (PA) and reduce health disparities among different racial and ethnic segments of the U.S. population. Few studies have been conducted to examine PA differences by birthplace and sex in youth of Mexican heritage. **Methods:** Participants were 101 youth (43 boys, 58 girls, 59% U.S.-born, 41% Mexico-born) who wore a sealed New Lifestyles NL-1000 pedometer for 7 consecutive days. **Results:** Mexico-born youth took more steps, on average, than their U.S.-born counterparts ( $P = .038$ ). However, moderate-to-vigorous intensity (MVI) time did not differ between Mexico- and U.S.-born youth ( $P = .146$ ). By contrast to birthplace, sex-related differences were more consistent, as boys took more steps ( $P = .005$ ) and accumulated more MVI time ( $P = .043$ ) than girls. Only 4% of our sample met either one or both of the PA recommendations. **Conclusions:** We conclude that PA may differ by birthplace and by sex in youth of Mexican heritage, as U.S.-born girls were the least active segment of our sample. Culturally sensitive interventions to increase daily PA must become a higher public health priority for youth of Mexican heritage, in particular, for U.S.-born girls of Mexican heritage.

**Keywords:** pedometer, culture, Hispanic

Insufficient physical activity (PA) in youth has contributed to increases in the obesity prevalence and cardiovascular disease (CVD) risk factors.<sup>1-4</sup> Obesity is the most critical factor for hypertension, and it is related to abnormal lipid profiles in youth.<sup>5</sup> Some of the diseases associated with a positive energy balance due to some combination of low PA and excess caloric intake include obesity, coronary heart disease (CHD), Type 2 diabetes, hypertension, selected cancers, and musculo-skeletal disorders.<sup>6-9</sup> If youth continue to not meet PA recommendations, and this insufficient PA is not addressed, many of the inactive youth of today will become the inactive adults of tomorrow. Consequently, this lack of PA may contribute to an estimated total annual obesity-related health care cost in the U.S. of \$334 billion by 2018.<sup>10</sup>

A comprehensive review recommends that all youth engage in at least 60 minutes of moderate-to-vigorous intensity (MVI) PA daily.<sup>11</sup> However, a large cohort study using accelerometers to assess PA found the youth aged 11 were insufficiently active and a majority did not meet recommended daily MVI time.<sup>12</sup> According to the 2009 national Youth Risk Behavior Survey, only 34.7% of American youth in grades 9 to 12 met recommended daily

PA amounts on 5 or more days of the week, whereas 32% of these youth viewed television 3 or more hours per day during school days.<sup>13</sup> Approximately, 67% of high school youth do not attend daily PE classes. Overall male youth met PA recommendations more often than female youth.<sup>13</sup>

Birthplace has been shown to increase the risk of CHD, CVD, and obesity.<sup>14-18</sup> Studies have shown that individuals of the same origin living in different parts of the world have different risks of CHD and increased body weight. One classical health study of Japanese men residing in Japan, Hawaii, and California reported that the occurrence of CHD was lowest in Japanese men living in Japan, intermediate in Japanese men living in Hawaii, and highest in Japanese men living in California.<sup>17</sup> A similar trend occurred in genetically related Pima Indians residing in Mexico and the U.S. Pima Indians living in Mexico were significantly more physically active than the Pima Indians living in the U.S.<sup>18</sup> It has been reported that Hispanic youth who are more acculturated are more likely to be physically inactive than Hispanic youth who are less acculturated.<sup>19,20</sup> There is some *longitudinal* evidence that Hispanic school-age youth in southern California become progressively more inactive, as they progress through higher grades, and presumably, become more acculturated.<sup>21</sup> However, the exact association between PA levels assessed by birthplace and sex is not well known in youth of Mexican heritage aged 12 to 19 years.

Hispanic immigration patterns to the U.S. have created a large youth population who experience cultural influences from the U.S. as well as their country of origin. Hispanics comprised 13.7% of the nation's total

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population, which is projected to increase from 39.9 million in 2003 to 102.6 million people in 2050.<sup>22</sup> The majority of Hispanics in the U.S. are of Mexican heritage (67%).<sup>22</sup> Hispanic subgroups in the U.S. are younger, have less education, and lower economic status compared with White Caucasians.<sup>23</sup> Some minority subgroups with low socioeconomic status in the U.S., including Mexican-American women and children, appear to be highly prone to disparities in obesity.<sup>2,23</sup> In particular, Hispanic youth experience a highly unbalanced burden of multiple health behavior risk factors and suboptimal health status.<sup>24-26</sup>

Ecological systems theory (EST) of health behavior suggests that individuals' participation in PA should be explained within larger ecological contexts.<sup>27</sup> This EST explains associations among the different levels of factors and how factors are interrelated and moderated with other factors.<sup>27</sup> According to this EST, "an ecological niche includes not only the immediate context in which a person is embedded, but also the contexts in which that context is situated" (p. 160).<sup>27</sup> The EST relating to youth includes the families and school in which individuals are surrounded in broader contexts such as community and society.<sup>27</sup> In particular, youth's participation in PA is impacted by age, socioeconomic status, parents' support, accessibility and availability of sport facilities, and school physical education (PE) programs as well as certain biological characteristics such as sex and ethnicity.<sup>27</sup> In this current study, EST was used as a framework to understand the association between birthplace and sex and PA in youth of Mexican heritage.

One of the goals of *Healthy People 2020* is to increase PA levels and reduce health disparities among different racial and ethnic segments of the U.S. population.<sup>28</sup> Few studies have been conducted to examine PA differences by birthplace and sex in youth of Mexican heritage. Therefore, the primary aim of this study was to objectively assess whether daily PA, using a pedometer with a MVI timer, differs between U.S.-born and foreign-born youth of Mexican heritage aged 12 to 19 years. A secondary aim of the study was to determine whether PA differs by sex. The final aim of the study was to determine whether youth of Mexican heritage meet current daily PA recommendations.

## Methods

### Participants and Settings

Initially, 151 participants took part in this study; 50 participants either lost their pedometers or did not comply with the pedometer protocol guidelines, resulting in a final sample size of 101 participants (43 boys and 58 girls; Mean  $\pm$  SD age of  $14.8 \pm 1.4$  years). Approximately 59% were U.S.-born and 41% were Mexico-born. The nonprobability sampling method, targeted sampling, was used to select participants. Specific target neighborhoods were chosen based on a high percentage of the Mexican heritage population residing in the area. Specific targeted places included 2 boys and girls clubs and 4 Catholic

churches. This study took place in a large Southwestern U.S. city. Recruitment strategies consisted of flyer distributions and word of mouth. The study protocol was approved by the University Institutional Review Board. Informed youth assent and parental consent forms (ages between 12 to 17 years) and informed participant consent forms (ages between 18 to 19 years) were obtained before participation in the study.

### Instrumentation and Measures

Measured heights and weights, daily steps, MVI time over the past 7 days, and general demographic information were collected by trained bilingual graduate student research staff under the supervision of the principal investigator. All questionnaires and forms used for the study were available in both English and Spanish versions.

### Demographic Questionnaire

Participants filled out a demographic questionnaire reporting their sex, age, birthplace, and years of residence in the U.S. Participants also disclosed their parents' annual income, parents' marital status, and parents' education. The participants also were asked whether they were physically ill and took any medications which could influence normal daily PA participation corresponding to our exclusion criteria.

### Anthropometric Measures

Participants height was measured to the nearest 0.1 cm using a stadiometer (Seca Road Rod, Seca Corp, Hanover, MD), and weight was measured to the nearest 0.1 kg using a calibrated digital scale (Tanaka Corp, Tokyo, Japan). The BMI was calculated as the weight in kilograms divided by the square of the height in meters. All anthropometric measurements were conducted by trained research staff.

### Physical Activity

Physical activity was assessed using a New Lifestyles NL-1000 activity monitor (New Lifestyles Inc, Lees Summit, MO). The New Lifestyles NL-1000 employs a piezo-electric accelerometer mechanism and can accumulate and store in memory up to 7 days of steps, as well as MVI time, in 1-day epochs. Unlike traditional spring-levered pedometers, piezo-electric pedometers have been found to count steps within  $\pm 3\%$  actual steps accumulated, 95% of the time, regardless of overweight status.<sup>29</sup> Piezo-electric pedometers also are more accurate for overweight and obese people at slower walking speeds than a traditional spring-levered pedometer.<sup>30</sup> In this current study, we included participants who wore the pedometer at least 2 weekdays and 1 weekend day and excluded participants who wore the pedometer less than 1000 steps or who exceeded 30,000 steps per day, meeting the pedometer step criteria suggested by Rowe and

researchers.<sup>31</sup> In this study, the pedometers were sealed to prevent the possibility of loss of data.

## Procedures

The research staff visited targeted places for data collection. Before initiating the study, the research staff was provided with a description of the study protocol and they were required to attend a training session to ensure how to collect and record all study related data. However, the principal investigator primarily recorded the pedometer data (eg, MVI time and steps) and the research staff double-checked the data. During the first visit the participant's height, weight, and demographic information were obtained by the research staff. Distribution of the pedometer and paper recording log took place during the first visit. The participants were asked to wear a sealed New Lifestyles NL-1000 pedometer on their belt or their waistband at the midline of the thigh all day for 7 days, except while sleeping at night and during any water-based activities. The participants were asked to record the time that the pedometer was put on and taken off on the paper recording log. To ensure compliance with the pedometer protocol, the research staff conducted a pedometer instruction session regarding how to wear the pedometer and to record their wearing time in the paper log. After the pedometer orientation session, a few practice sessions and a quiz (eg, oral questioning about the pedometer protocol) were conducted to make sure participants understood the pedometer protocol. In addition, the research staff visited the sites to remind the participants to wear the pedometer and called the director of the research sites during the pedometer wearing period. Immediately after completing the orientation session regarding use of the pedometers and recording log, participants were asked to remove their shoes and any heavy clothing they were wearing (ie, jackets, heavy sweats) so that they were only in light clothing (ie, t-shirt and shorts). Height and weight were then measured. Exactly 1 week later, the participants made a second visit to the target location to return the pedometer and recording log. Participants were given a pedometer and key holder as incentives for their participation in the study.

## Statistical Analysis

A descriptive comparative design was used to examine birthplace-related differences in PA (ie, average total steps and average MVI time per day) in youth of Mexican heritage aged 12 to 19 years. Data were entered and results generated using SPSS (Version 15.0, Chicago, IL). Descriptive data were calculated as frequencies and reported as percentages. Independent *t* tests were used to examine birthplace-related differences in daily PA. A contingency table Chi-square analysis was proposed to examine birthplace-related differences in the categorical variable for recommended amounts of PA. An alpha level of 0.05 was used for all statistical tests.

## Results

The values for demographic information and anthropometric data are presented in Table 1. Mexico-born female youth had slightly lower values for BMI than U.S.-born female youth. A majority of the participants lived with both parents. Over 83% of the participants parents had a high school education or did not complete high school. A higher percentage of the parents of U.S.-born youth had high school and  $\geq 2$ -year college diplomas than the parents of Mexico-born youth. A majority of the participants (67%) spoke both English and Spanish equally in their homes. Approximately 51.2% of Mexico-born and 33.3% of the U.S.-born youth lived in homes reporting an annual income of \$25,000 or less.

Overall mean differences and standard deviations for average daily steps (steps/d) and average daily minutes (min/d) for MVI are displayed in Table 2. We hypothesized daily PA would be lower, on average, in U.S.-born than in Mexico-born youth. We found that the birthplace-related steps/d difference was significant on weekend days and for average steps/d. Mexico-born youth had significantly higher average steps on weekend days compared with their U.S.-born counterparts. We also observed that Mexico-born youth had significantly higher average steps/d than their U.S.-born counterparts. There was not a significant difference for average min/d pedometer-assessed MVI time between Mexico-born and U.S.-born groups. Similarly, no significant difference was found on average pedometer-assessed MVI time on weekend days. Although there was an unequal sample size within the female group, Mexico-born female youth took significantly higher average steps/d than the U.S.-born female youth. In addition, Mexico-born male youth accumulated more steps on weekend days than U.S.-born male youth, but no statistical difference was found between the groups. Overall, Mexico-born male youth took the highest average number of steps/d, whereas U.S.-born female youth had the lowest number of steps/d. The participants in this study appeared to be more active on weekdays than on weekend days. There was a large discrepancy between steps and MVI engagement on weekdays and on weekend days, showing the participants in the current study accumulated more steps and more time in MVI on weekdays.

The values for daily PA by sex are displayed in Table 3. Sex differences in PA were statistically significant; the male youth, compared with the female youth, had higher average steps/d. There was a significant step difference on weekend days, showing that the male youth took considerably more steps than that of the female youth. There was a significant MVI time difference on weekdays. The male youth spent significantly more time in MVI than the female youth. We found that the participants regardless of sex took approximately 32% fewer steps on weekend days than on weekdays.

We compared our PA data with recommended amounts of steps/d<sup>32</sup> and MVI min/d.<sup>11</sup> The current study

**Table 1 Birthplace-Related Difference in Descriptive Characteristics**

Variable	MBY (n = 41)	USBY (n = 60)
	Mean ± SD	Mean ± SD
Age (yr)	14.8 ± 1.4	14.8 ± 1.5
Duration of US residency (yr)	9.3 ± 4.3	14.5 ± 2.1
BMI (kg.m <sup>2</sup> )		
Female youth	22.8 ± 2.5	24.7 ± 5.8
Male youth	25.8 ± 4.0	26.1 ± 6.1
Sex		
Female youth (n)	17	41
Male youth (n)	24	19
Language usually spoken at home		
English	3	18
Spanish	4	5
Both equally	34	37
Household income		
<\$15,000	8	10
\$16,000–\$25,000	13	10
\$26,000–\$35,000	7	16
\$36,000–\$45,000	4	8
\$46,000–\$55,000	5	4
\$56,000–\$65,000	2	6
>\$66,000	2	6
Marital status		
Separated/divorced	7	10
Widowed	1	0
Married/living together (not married)	33	50
Parental education		
< High school	27	25
High school	8	24
>2-yr college	6	11

Abbreviations: SD, standard deviation; BMI, body mass index; MBY, Mexico-born youth; USBY, U.S.-born youth.

**Table 2 Steps/d and MVI Min/d Differences by Birthplace**

Variable	MBY (n = 41)	USBY (n = 60)	P
	Mean ± SD	Mean ± SD	
Avg. weekday steps	9181.7 ± 3724.6	8168.9 ± 3908.4	0.195
Avg. weekend steps	6846.9 ± 3299.8	5195.4 ± 2243.2	0.007*
Avg. weekday MVI (min)	27.0 ± 16.7	22.5 ± 16.7	0.186
Avg. weekend MVI time (min)	12.5 ± 10.3	11.0 ± 6.8	0.367
Avg. total steps/d <sup>-1</sup>	8527.2 ± 3059.1	7273.5 ± 2859.4	0.038*
Avg. total MVI time (min)	22.9 ± 13.6	19.1 ± 12.3	0.146

Abbreviations: SD, standard deviation; MBY, Mexico-born youth; USBY, U.S.-born youth; MVI, moderate-to-vigorous intensity.

\* Significantly different at  $P < .05$ .

**Table 3 Steps/d and MVI Min/d Differences by Sex**

Variable	Female youth (n = 58)		Male youth (n = 43)	P
	Mean ± SD		Mean ± SD	
Avg. weekday steps	7725.7 ± 2573.2		9732.4 ± 4889.9	0.017*
Avg. weekend steps	5226.4 ± 2423.6		6728.3 ± 3118.1	0.008*
Avg. weekday MVI (min)	21.2 ± 11.9		28.6 ± 21.0	0.045*
Avg. weekend MVI time (min)	10.8 ± 7.2		12.7 ± 9.8	0.258
Avg. total steps/d <sup>-1</sup>	7016.7 ± 2170.2		8815.4 ± 3607.6	0.005*
Avg. total MVI time (min)	18.2 ± 9.5		23.9 ± 16.0	0.043*

Abbreviations: Avg., average; SD, standard deviation; MVI, moderate-to-vigorous intensity.

\* Significantly different at  $P < .05$ .

**Table 4 Comparison of Our Findings With the Recommended Amounts of Physical Activity**

Variable	Recommended pedometer steps				Recommended MVI time			
	Tudor-Locke et al (2004)				Strong et al (2005)			
	Female (n = 58)		Male (n = 43)		Female (n = 58)		Male (n = 43)	
	MBY	USBY	MBY	USBY	MBY	USBY	MBY	USBY
Yes	1	0	2	1	0	0	1	1
No	16	41	22	18	17	41	23	18

Abbreviations: MBY, Mexico-born youth; USBY, U.S.-born youth; MVI, moderate to vigorous intensity.

used the recommended cut-points of 15,000 steps/d for male youth and 12,000 steps/d for female youth and the recommended level of 60 min/d MVI time for both sexes. The current study intended to use *chi-square* tests to determine whether the percentage of youth who met the recommended values of 15,000 steps/d for boys and 12,000 steps/d for girls<sup>32</sup> and the percentage of youth who met the recommended 60 min/d of MVI<sup>11</sup> differed by birthplace and sex. However, insufficient numbers of youth met the PA recommendations for statistical analysis (see Table 4). Only 2 Mexico-born boys, 1 Mexico-born girl, 1 U.S.-born boy, and 0 U.S.-born girls met either one or both of the recommended amounts of PA.

## Discussion

The primary purpose of this study was to objectively assess whether daily PA differs between U.S.-born and foreign-born youth of Mexican heritage aged 12 to 19. We hypothesized that Mexico-born youth would be more physically active than U.S.-born youth. Based on Independent *t*-test analysis, we observed a birthplace-related difference in average steps/d and in weekend steps. Mexico-born youth in the current study accumulated more steps/d and average weekend steps than their U.S.-born counterparts. The current study observed large step differences on weekdays versus weekend days between both the Mexico-born and U.S.-born groups

overall, indicating that Mexico-born youth took 2235 fewer steps and U.S.-born youth took 2973 fewer steps on weekend days.

With respect to pedometer assessed MVI min/d, there was no significant difference in Mexico-born and U.S.-born groups. We observed a significant MVI min/d difference between weekdays and weekend days regardless of birthplace and sex. The participants in the current study spent more min/d in MVI on weekdays than on weekend days. Within female and male participants, the female participants spent 21.2 versus 10.8 min/d and the male participants spent 28.6 versus 12.7 min/d in MVI between weekdays and weekend days. The findings of the current study are consistent with a previous study which reported that participants were more active on weekdays than on weekend days,<sup>33</sup> reporting 26 versus 18 min/d in MVI on weekday versus weekend days.

We found significant sex differences, indicating male participants accumulated higher average steps/d than female participants. We also observed step differences on weekend days by sex, showing male participants took more steps on weekend days. Furthermore, the Mexico-born male youth took the highest average steps/d, whereas U.S.-born female youth took the lowest average steps/d. While we found no significant difference in MVI min/d by birthplace, we did observe MVI min/d difference by sex, indicating male youth engaged in more MVI min/d both on weekdays and weekend days. The result of this sex difference in daily PA is in agreement with previous

studies which found boys are more likely to engage in more MVI than girls.<sup>34,35</sup>

It is recommended that all youth engage in at least 60 min/d of MVI.<sup>11</sup> Comparing our findings to the recommended PA guidelines,<sup>11,31</sup> we found that our participants spent, on average, 20.6 min/d in MVI. The majority of the participants in this study did not meet the recommended 60 min/d MVI time.<sup>11</sup> In addition, Tudor-Locke and colleagues recommend minimal steps/d for boys and girls are 15000 and 12000 steps/d.<sup>32</sup> The average mean steps obtained from this study was 8815 steps/d for male and 7016 steps/d for female participants. Only 4% of the participants in this study met the recommended steps/d and MVI min/d. The participants in the current study were fairly inactive when compared with a previous study.<sup>36</sup> Duncan and colleagues objectively assessed daily step counts in youth aged 5 to 16 years using a similar pedometer as the current study (eg, the New Lifestyles NL-2000 pedometer, Lee's Summit, MO). The researchers reported mean steps of 12597 versus 9528 on weekday and weekend days.<sup>36</sup> The mean steps for the females obtained from the current study were 7775 and 5241; the mean steps for the male participants were 9727 and 6631 on weekday and weekend days. A recent study reported that only 55% of youth aged 11 to 15 years failed to meet the recommended PA guideline (assessed with accelerometers).<sup>37</sup> Although a majority of the participants in this study did not meet the recommended daily PA, the participants at least appeared to be more active on weekdays than on weekend days. We observed that the participants took approximately 32% fewer steps on weekend days than on weekdays. We conclude that the observed step difference between weekdays and on weekend days may be, in part, due to the participation in daily PE programs during the weekdays. Furthermore, it is also possible that the participants did not wear their pedometers as much as they reported doing so or for as long as they reported. Although we did not report the types of PA in the current study, a majority of the participants reported that they spent most of their time watching TV, and playing video and computer games during weekend days. This is consistent with an earlier study that found a significant relationship between television watching and the prevalence of overweight in youth and that youth were less active on weekend days due to playing video and computer games.<sup>38,39</sup> Additionally, only 34.7% of American youth in grades 9 to 12 met recommended daily PA amounts on 5 or more days of the week, whereas 32% of these youth viewed television 3 or more hours per day during school days.<sup>13</sup> Physical activity behaviors in youth have been defined by multiple variables.<sup>39</sup> It has been reported that enjoyment of PE, use of afternoon time, and family support and certain biological characteristics such as sex and ethnicity were strongly associated with PA.<sup>27,40</sup> However, Hispanic youth in low income families were less likely to participate in organized sports due to, in part, financial matters (ie, fees for participation and other equipment).<sup>41,42</sup> Hispanic families are 3 times more likely than White Caucasian families to live in poverty.<sup>43</sup>

According to the US Census Bureau,<sup>44</sup> the nation's and Hispanics' median annual household income in 2008 was \$52,029 and \$35,967. The median household income in the State in which this study took place was \$36,944.<sup>44</sup> The range of the median household income in the current study is \$26,000-\$35,000. This implies that family support may be difficult for poorer Hispanic families as it relates to organized sport experiences. However, families can take advantage of free local park space to engage in family-centered physical activities. In addition, if PE is required, youth may receive at least a minimum amount of the recommended daily PA.<sup>45</sup> It is therefore important that schools provide an adequate amount of PE time, since for many of these poorer youth, it may be the only time of the day that they get to participate in organized and supervised PA.

According to EST, individuals' growth and change occur by interacting in the contexts that impact individuals' health behavior.<sup>27</sup> The current American environment has been introduced as an "obesogenic" society due to society's promotion of an energy imbalance that includes consuming a high calorie diet with low energy expenditure due to sedentary lifestyles.<sup>46</sup> The modern, multifaceted, and westernized lifestyle in the U.S, particularly for Mexico-born youth, may contribute to their high prevalence of physical inactivity by interacting within and between these contexts. In addition, youth's characteristics (eg, age, sex), school programs, parents' support, available and accessible sports facilities impact health behavior.<sup>27</sup> All our participants are school-aged youth and most of them reported to attend PE from the activity list in their given log. Therefore, we conclude that the participants in this current study were able to obtain more MVI time and steps during weekdays by participating in PE programs and other activities such as after school programs, more walking during weekdays. Therefore, comprehensive lifestyle interventions including behavior modification should be targeted for Mexican American youth in the U.S.

Although this study addresses a gap in the literature related to PA among youth of Mexican heritage, it is not without limitations. Major limitations of this study included a small sample of individuals from a single community, limiting our ability to generalize the significant associations found. We may be able to observe more significant birthplace-related differences with a larger sample size obtained from several communities, because we found that there were some positive trends observed among the proposed outcome variables. For instance, there were some significant step differences on weekend days by birthplace. We also observed time discrepancy on MVI engagement between weekdays and weekend days. In addition, although sample size was not evenly distributed by birthplace and sex, Mexico-born female youth were found to be more active than U.S.-born female youth.

Despite the identified limitations, the findings of the current study offer some important insights into the birthplace-related differences in youth of Mexican

heritage aged 12 to 19 years. We are aware of few previous studies examining birthplace-related difference on PA, specifically in youth of Mexican heritage aged 12 to 19 years. The findings of the current study indicate that youth of Mexican heritage regardless of birthplace and sex were inactive and they were more likely to be inactive during weekend days. Birthplace difference was found to be significant in daily PA, showing that U.S.-born participants took fewer steps/d on weekend days than their Mexico-born counterparts. Time spent in MVI was different between weekdays and weekend days. The participants in the current study spent more min/d in MVI on weekdays than on weekend days. Approximately, 4% of the participants in the current study met the recommended PA guidelines. A pedometer is a practical and feasible alternative to self-report PA methods, because it provides actual information regarding steps and MVI time. It is important to acknowledge that the results of this cross-sectional study limit inference about the causality effect of this study.

The following include some considerations for future research. Future researchers should attempt to recruit a larger number of participants to have an even distribution by sex and birthplace. A researcher must have access to this population and work closely with community leaders and directors to reduce dropout rates and to obtain quality data. It is important to use culturally-competent/connected research staff who understands the culture, language, and literacy levels of participants. Using a research staff composed of individuals unfamiliar to the community to introduce the study and to help with the administration may be viewed suspiciously by participants and their family members. In addition, future studies should consider collecting parents' PA history as a moderator that may be related to their children's PA behaviors.

Given the fact that relatively few studies have been published addressing specific birthplace differences, more research is clearly needed to address the understanding of the causal pathways using birthplace as a predictor of PA in youth of Mexican heritage. This will, in turn, help us promote the development of more culturally sensitive and appropriate strategies for PA based interventions in the Mexican-American community.

### Acknowledgments

The authors would like to thank the colleagues who helped with data collection and participant recruitment and the participants who made this project possible. This research was supported in part by a North American Society of Pediatric Exercise Medicine student research grant.

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