HHS Public Access

Author manuscript

J Phys Act Health. Author manuscript; available in PMC 2018 January 08.

Published in final edited form as:

J Phys Act Health. 2016 July ; 13(7): 740–746. doi:10.1123/jpah.2015-0482.

Long-term Surveillance of Physical Activity Habits of Latinas Enrolled in a 12-Month Physical Activity Intervention

Lucas J. Carr,

Dept of Health and Human Physiology, University of Iowa, Iowa City, IA

Shira Dunsinger, and

Centers for Behavioral and Preventive Medicine, The Miriam Hospital, Providence, RI

Bess H. Marcus

Dept of Family and Preventive Medicine, University of California-San Diego

Abstract

Background—Long-term physical activity surveillance has not been conducted among Latinas. This study explored the variability of daily physical activity habits of inactive adult Latinas participating in a 12-month physical activity intervention.

Methods—We collected objective physical activity data (pedometer) from 139 Spanish speaking Latinas (age = 41.6 ± 10.1 years; BMI = 29.6 ± 4.3 kg/m^2) enrolled in a 12-month physical activity intervention. Total and aerobic steps (>100 steps/minute) were computed by year, season, month, day of week, time of day, and hour.

Results—Participants walked an average of 6509 steps/day of which 1303 (20%) were aerobic steps. Significant physical activity differences were observed for subgroups including generational status, education, employment, income, marital status and health literacy. Significant and similar differences were observed for both total steps and aerobic steps for day of the week (weekdays > weekends) and season (summer > spring > fall > winter). Opposing trends were observed over the course of the day for total steps (early afternoon > late morning > late afternoon > early morning > evening) and aerobic steps (early morning > evening > late morning > late afternoon > early afternoon).

Conclusions—Both seasonality and week day predicted physical activity habits of Latinas. This is the first long-term study to track daily physical activity habits of Latinas. These data have potential to inform the design of future physical activity interventions targeting Latinas.

Keywords

pedometer; accelerometer; surveillance

Regular physical activity has been established as an effective therapy for the primary and secondary prevention of several chronic diseases (eg, cardiovascular disease, diabetes, cancer, hypertension, obesity, depression and osteoporosis) and premature death.[1] Given the many benefits of regular physical activity along with alarmingly low prevalence rates of regular physical activity among U.S. adults,[2] there is a need for effective interventions that promote regular lifestyle physical activity. Multiple Cochrane reviews have concluded

physical activity interventions tend to have positive effects on self-reported physical activity adoption.[3,4] These reviews also concluded, however, that 1) too few studies resulted in long-term adherence to physical activity after the conclusion of the intervention, 2) too few studies included participants from varying socioeconomic or ethnic groups, and 3) longer studies are needed to understand the impact of individual intervention components.

It is arguable that conducting a number of long-term interventions is an impractical approach for understanding how to effectively and efficiently promote regular physical activity among sedentary individuals. A more efficient way of understanding how individuals respond to physical activity interventions would be to collect surveillance physical activity data at the individual level during the course of a fully-powered, long-term physical activity intervention. This approach, known as public health surveillance, has been defined as "the ongoing systematic collection, analysis, and interpretation of data, closely integrated with the timely dissemination of these data to those responsible for preventing and controlling disease and injury."[5] It is suggested that surveillance data collection can lead to more efficient implementation of preventive programs if the data are collected in a timely and accurate manner.[6]

In the field of physical activity promotion, many reliable and cost-feasible physical activity monitors are now commercially available to collect long-term surveillance physical activity data. Pedometers have been identified as a useful tool for both measuring and encouraging physical activity. Pedometers have also been established as a feasible, practical and valid measure of walking behavior.[7–9] A review of 8 randomized controlled trials found pedometer users significantly increased their daily physical activity by 2491(26.9%) steps/day illustrating their potential for increasing daily physical activity behaviors.[10]

In general, very few physical activity surveillance studies have tracked daily physical activity habits long-term using objective monitors.[11] Tudor-Locke and colleagues used pedometers to measure the daily physical activity habits of 23 middle-aged, overweight men and women over a full year.[12] Despite a small and nongeneralizable sample, this study yielded important advances in our understanding of the natural variability of physical activity over the course of the year,[12] duration of physical activity measurement necessary to estimate typical physical activity behaviors[13] and how seasonality affects physical activity measurement.[14] More recently, Morrow et al tracked long-term daily physical activity behaviors of 917 middle-aged women in the Women's Injury Study (WIN). This study has advanced our understanding of long-term physical activity habits of community-living women,[15] the relation between habitual physical activity and musculoskeletal injuries,[16] and the costs associated with physical activity related musculoskeletal injuries.[17]

To our knowledge, no physical activity interventions have tracked daily physical activity behaviors objectively over the course of a full year. The standard practice for physical activity interventions is to monitor participant's physical activity for a short duration (eg, 3 to 7 days) at multiple time points (eg, baseline and postintervention) to estimate changes in physical activity habits over time. Previous research suggests 3 to 7 days is sufficient for estimating typical physical activity behaviors.[13,18] This approach, however, disregards the individual's physical activity behaviors during the course of the intervention which limits

our ability to understand how individuals respond to physical activity intervention components over time. To advance our understanding of how physical activity interventions impact individual physical activity behaviors both acutely and long-term, there is a need to employ physical activity surveillance methods during the course of physical activity interventions. This approach will allow for designing smarter physical activity interventions that result in sustained physical activity habits among sedentary populations.

Our team employed surveillance physical activity methods during a recently completed 12 month randomized controlled physical activity trial testing a print-based physical activity intervention against a wellness control among 266 sedentary Latinas.[19,20] In an effort to more clearly understand the impact of individual components of the intervention, all participants were asked to wear a physical activity monitor (Omron HJ 720-ITC, Omron Health Care, Inc.) every day for 12 months that measured total steps and moderate intensity aerobic steps (100+ steps/minute) at both hourly and daily intervals. This detailed, longitudinal surveillance data will allow us to examine individual variability of physical activity over the course of an entire year. Therefore, the purpose of this study was to explore the variability of objectively measured physical activity among inactive adult Latinas participating in a 12 month print-based physical activity intervention.

Methods

Participants

The current study was a secondary data analysis of a recently completed study (Seamos Saludables; NR011295) designed to test the efficacy of an individually tailored, culturally and linguistically adapted print intervention vs. wellness contact control to increase MVPA among 266 Latinas.[19,20] Adult women (aged 18 to 65 years) who self-identified as Hispanic or Latina, could read and write in Spanish, and were underactive (<60 minutes of MVPA/week) were recruited for participation in the trial. A total of 132 participants (mean age = 41.6 + 10.1 years; mean body mass index = 25.6+4.3 kg/m^2) were randomized to a 12 month print-based physical activity intervention. The print-based intervention group received materials through the mail 11 times during the first 6 months, then booster doses at 8, 10, and 12 months, with a final assessment at 12 months. Participants were also provided a pedometer to wear every day for 12 months. The wellness contact control group received general health information on topics other than physical activity, including bilingual pamphlets on heart-healthy behaviors developed by the National Heart, Lung, and Blood Institute (NHLBI) for Latinos. Further, details of the intervention have been previously described.[20] The primary findings of the Seamos Saludables study found participants randomized to the Print intervention significantly increased self-reported minutes/week of MVPA compared with a wellness contact control group at 6 months and these changes were maintained at 12 months.[19,20] The current study explored the daily physical activity habits of those randomized to the print-based intervention group only.

Data Collection

Upon enrollment into the study, all participants completed a questionnaire that asked about demographics and health literacy. Daily physical activity behaviors were tracked with an

Omron HJ-720ITC pedometer which participants were asked to wear every day for 12 months. The Omron HJ-720ITC pedometer was chosen specifically for this study for several reasons. First, the Omron HJ720ITC pedometer has been demonstrated as both valid and reliable at various mounting positions under prescribed and self-paced walking conditions with both healthy and overweight adults.[21] The monitor uses a dual-axis which tracks steps horizontally and vertically. The pedometer also automatically resets each day at midnight, minimizing the need to self-report daily steps on a log. The pedometer stores 41 days of memory which can then be directly downloaded to a desktop computer. Finally, the pedometer tracks total steps and moderate intensity aerobic steps (>100 steps/minute) at both daily and hourly frequencies allowing for fine level analyses. Because the pedometer only held 41 days of memory, participants wore a single pedometer for 1 month (30 days). After 30 days, they received a new pedometer and return envelope in the mail. Participants began wearing the new pedometer they received in the mail the next month and returned the previous month's pedometer to our research staff via mail for downloading. Participants completed this monthly exchange each month for 12 months.

Statistical Analysis

Demographics and health literacy scores were summarized by physical activity outcomes (depicted in Table 1). Descriptive data (Mean ± SD, 95% confidence interval) for steps/day were computed for the whole year, by season, by month, by type of day (weekdays, weekend days), by day of week (Sunday, Monday, etc), by time of day (early morning, late morning, early afternoon, late afternoon, evening), and by hour. The proportion of days at previously established daily step indices (<5000 steps/day, 5000 to 7500 steps/day, 7501 to 9999 steps/day, 10,000 to 12,499 steps/day or more, and ≥12,500 steps/day) was calculated.[22] A repeated measures analysis of variance (ANOVA) was applied to examine effects due to season, month, type of day, day of week, time of day and hour. In the case of significant differences between more than 2 categories, post hoc pairwise comparisons (with Bonferonni or Dunn's correction depending on normality) were conducted. The alpha level was set at $P < .01$ for all comparisons.

Results

We collected daily step data from 132 Spanish speaking Latinas (age = 41.6+10.1 years; BMI = 29.6+4.3 kg/m^2) who completed a 12 month physical activity intervention. Of a possible 50,735 days of data, participants wore the pedometers for 31,296 person days (61.6% adherence). After excluding days with less than 8 hours of wear time[23] (9612 days; 30.7% of total observation sample) we analyzed 21,685 person days. Each participant provided an average of 156 full days of data (42.7% adherence). On those days, participants wore the monitor for an average of 13.7(2.7) hours per day.

When comparing physical activity habits by demographic subgroups, several between group differences were observed (Table 1). Specifically, higher physical activity levels (total steps, aerobic steps, aerobic walking time) were observed among first generation status individuals, less educated individuals, individuals who were employed either part or full-

time, individuals with a yearly household income greater than $10,000, single individuals, and individuals with adequate or functional health literacy scores.

As indicated in Table 2, participants walked an average of 6509 (3799) total steps/day of which 1303 (2686) were counted as aerobic steps. Participants completed an average of 11.5 (23.7) minutes of aerobic walking/day. Significant between group differences were observed for both total steps and aerobic steps by season (summer > spring > fall > winter), month and weekday type (weekdays > weekends) (see Figure 1). Significant but opposing trends were observed for total steps achieved over the course of the day (early afternoon > late morning > late afternoon > early morning > evening) and aerobic steps achieved over the course of the day (early morning > evening > late morning > late afternoon > early afternoon) (see Figure 2).

The majority of all observed days were in the sedentary (42.1%) or low active step indices (26.8%). Participants were somewhat active on 13.9% of all days, active on 9.7% of all days and highly active on 7.5% of all days. Participants achieved 10,000 steps on 17.2% of all days.

Participants achieved less than 10 minutes of aerobic walking time on 71.8% of all days, 10 to 29 minutes of aerobic walking time on 11.8% of all days, and 30+ minutes of walking time on 16.4% of all days (see Table 3).

Discussion

This is the first study to track daily physical activity behaviors of a cohort enrolled in a physical activity intervention for a full year. This is also the first study to track long-term physical activity behaviors of Latinas. Recognizing the inclusion criteria for the physical activity intervention limit the overall generalizability of this sample, we can still make some comparisons to previous studies. Participants of the current study walked an average of 6509 steps/day with 42.1% of all person days <5000 steps and only 17.2% of all days >10,000 steps. Tudor-Locke et al observed 23 middle-aged male and female participants (not enrolled in a physical activity intervention) walked an average of 10,090 steps/day with only 15.9% of all days <5000 steps/day and 28.5% of all days >10,000 steps/day.[12] Morrow et al reported 917 middle-aged women (also not enrolled in a physical activity intervention) walked an average of 6476 steps/day but did not report the prevalence of days in the sedentary and/or active category.[15] Participants in the current study met the recommended 30 minutes of MVPA (based on aerobic minutes) on 16.4% of all days. This is slightly lower than Morrow's data which suggest 23% of participants met the daily recommendations of >150 minutes per week.

The rich physical activity surveillance data captured in the current study allows us to fully explore physical activity differences among various subgroups of interest in this Latina population. This "physical activity profiling" has been recommended previously as a means for informing future physical activity interventions.[24] Among this sample of sedentary Latinas, significant physical activity differences were observed among Latino subgroups including generational status, education, employment status, income, marital status and

health literacy. First generation status participants were more active than second/third generation status participants. This finding is inconsistent with Gerber's systematic review which found physical activity to be positively associated with acculturation.[25] Greater health literacy was positively associated with physical activity levels in this population. This finding is consistent with a previous study showing a positive relation between physical activity and health literacy in older adults.[26] Health literacy has also been shown to predict self-efficacy for physical activity among sedentary Latinas.[27]

The between group differences by season and day of week in the current study are similar to those observed by Tudor-Locke et al.[12] In general, participants took more steps on weekdays than weekends with Sunday being the least active day. Seasonality differences in daily steps were observed with participants being most active in summer and least active in the winter. This finding is consistent with previous studies.[12,28] Participants walked the most steps during the summer months of June, July, August and September. Participants walked the least in the cold weather months of January, February and December. This finding is in opposition to previous research finding public interest in 'exercise,' as measured by search queries made on the internet, peaks in the months of January and February.[29]

Our data extend previous studies by reporting steps and aerobic steps by hour. Participants walked the most total steps in the late morning and early afternoon hours (10 AM to 4 PM) but engaged in the most aerobic steps in the evening (7 PM to 9 PM) and early morning (7 AM to 9 AM). This might suggest purposeful moderate intensity activity is most often performed early or late in the day while the middle of the day is a time of light intensity/ utilitarian activity. These data have potential to inform the timing and design of future physical activity interventions.

The study is has many strengths from both a conceptual and analytic view. To our knowledge, this study constitutes the first application of employing surveillance physical activity methods in a physical activity intervention study. To date, only 1 other study has collected physical activity surveillance data using pedometers over 12 months.[12] That study was limited by a small and nongeneralizable sample. Our study advances the field by analyzing a much larger sample and examining participants of a long-term randomized controlled physical activity trial. Our study also used a more advanced objective measure of physical activity that measures physical activity at both hourly and daily intervals and measures both total steps and moderate intensity activity steps. This feature allowed us to examine the role of physical activity intensity which was not included in previous physical activity surveillance studies. This study also has some limitations. Specifically, the validity and reliability of the Omron 720ITC pedometer for measuring aerobic steps has yet to be confirmed. Therefore, the findings related to aerobic steps should be interpreted with caution.

We believe the physical activity surveillance method employed in the current study could serve as a model for future physical activity interventions. Traditional methods of collecting cross-sectional physical activity data does not provide any indication of individual-level response trajectories, and existing longitudinal models may not suffice in adequately capturing between-subject heterogeneity or identifying subgroups of the population. Thus, a

new method is necessary to more accurately describe how physical activity behavior is impacted by individual intervention components and whether unique physical activity patterns predict long-term success in a physical activity intervention. For example, using the present physical activity surveillance data set, our next step is to determine whether unique individual physical activity patterns observed among participants of the original Seamos Saludables intervention predict long-term improvements in physical activity, cardiometabolic risk factors (eg, blood pressure, weight, waist circumference) and several psychosocial outcomes (eg, depression, social support, physical activity enjoyment and environment). Surveillance physical activity methodologies represent a more efficient approach to moving behavioral approaches aimed at promoting physical activity forward. Given the high prevalence of cancer and chronic diseases associated with physical inactivity, this could have important public health significance.

Acknowledgments

The authors thank Susan Carton-Lopez, Viveka Ayala-Heredia, Susan Pinheiro, Jane Wheeler and Jamie Longval of Brown University, Oluwatosin Adebiyi and Olubukola Adebiyi from the University of Iowa, as well as Raul Fortunet and Rachelle Edgar of the University of California, San Diego, for their valuable assistance with this project. This research was supported by the National Institute of Nursing Research at the NIH (Grant NR011295).

References

1. Warburton DE, Nicol CW, Bredin SS. Health benefits of physical activity: the evidence. CMAJ. 2006; 174(6):801–809. DOI: 10.1503/cmaj.051351 [PubMed: 16534088]
2. Troiano RP, Berrigan D, Dodd KW, Masse LC, Tilert T, McDowell M. Physical activity in the United States measured by accelerometer. Med Sci Sports Exerc. 2008; 40(1):181–188. DOI: 10.1249/mss.0b013e31815a51b3 [PubMed: 18091006]
3. Foster C, Richards J, Thorogood M, Hillsdon M. Remote and web 2.0 interventions for promoting physical activity. Cochrane Database Syst Rev. 2013; 9:CD010395. [PubMed: 24085594]
4. Hillsdon M, Foster C, Thorogood M. Interventions for promoting physical activity. Cochrane Database Syst Rev. 2005; (1):CD003180. [PubMed: 15674903]
5. Thacker SB, Berkelman RL. Public health surveillance in the United States. Epidemiol Rev. 1988; 10:164–190. [PubMed: 3066626]
6. Thacker SB, Berkelman RL, Stroup DF. The science of public health surveillance. J Public Health Policy. 1989; 10(2):187–203. DOI: 10.2307/3342679 [PubMed: 2745711]
7. Tudor-Locke C, Williams JE, Reis JP, Pluto D. Utility of pedometers for assessing physical activity: convergent validity. Sports Med. 2002; 32(12):795–808. DOI: 10.2165/00007256-200232120-00004 [PubMed: 12238942]
8. Tudor-Locke C, Williams JE, Reis JP, Pluto D. Utility of pedometers for assessing physical activity: construct validity. Sports Med. 2004; 34(5):281–291. DOI: 10.2165/00007256-200434050-00001 [PubMed: 15107007]
9. Strath SJ, Kaminsky LA, Ainsworth BE, et al. Guide to the assessment of physical activity: clinical and research applications: a scientific statement from the American Heart Association. Circulation. 2013; 128(20):2259–2279. DOI: 10.1161/01.cir.0000435708.67487.da [PubMed: 24126387]
10. Bravata DM, Smith-Spangler C, Sundaram V, et al. Using pedometers to increase physical activity and improve health: a systematic review. JAMA. 2007; 298(19):2296–2304. DOI: 10.1001/jama.298.19.2296 [PubMed: 18029834]
11. Hallal PC, Andersen LB, Bull FC, et al. Global physical activity levels: surveillance progress, pitfalls, and prospects. Lancet. 2012; 380(9838):247–257. DOI: 10.1016/S0140-6736(12)60646-1 [PubMed: 22818937]

12. Tudor-Locke C, Bassett DR, Swartz AM, et al. A preliminary study of one year of pedometer self-monitoring. Ann Behav Med. 2004; 28(3):158–162. DOI: 10.1207/s15324796abm2803_3 [PubMed: 15576253]
13. Kang M, Bassett DR, Barreira TV, et al. How many days are enough? A study of 365 days of pedometer monitoring. Res Q Exerc Sport. 2009; 80(3):445–453. DOI: 10.1080/02701367.2009.10599582 [PubMed: 19791630]
14. Kang M, Bassett DR, Barreira TV, Tudor-Locke C, Ainsworth BE. Measurement effects of seasonal and monthly variability on pedometer-determined data. J Phys Act Health. 2012; 9(3): 336–343. [PubMed: 21934156]
15. Morrow JR Jr, Bain TM, Frierson GM, Trudelle-Jackson E, Haskell WL. Long-term tracking of physical activity behaviors in women: the WIN Study. Med Sci Sports Exerc. 2011; 43(1):165–170. DOI: 10.1249/MSS.0b013e3181e61937 [PubMed: 20473221]
16. Morrow JR Jr, Defina LF, Leonard D, Trudelle-Jackson E, Custodio MA. Meeting physical activity guidelines and musculoskeletal injury: the WIN study. Med Sci Sports Exerc. 2012; 44(10):1986–1992. DOI: 10.1249/MSS.0b013e31825a36c6 [PubMed: 22525778]
17. Kaplan RM, Herrmann AK, Morrison JT, DeFina LF, Morrow JR Jr. Costs associated with women's physical activity musculoskeletal injuries: the Women's Injury Study. J Phys Act Health. 2014; 11(6):1149–1155. DOI: 10.1123/jpah.2012-0459 [PubMed: 24187018]
18. Masse LC, Fuemmeler BF, Anderson CB, et al. Accelerometer data reduction: a comparison of four reduction algorithms on select outcome variables. Med Sci Sports Exerc. 2005; 37(11, Suppl):S544–S554. DOI: 10.1249/01.mss.0000185674.09066.8a [PubMed: 16294117]
19. Marcus BH, Dunsiger SI, Pekmezi D, et al. Twelve-month physical activity outcomes in Latinas in the Seamos Saludables trial. Am J Prev Med. 2015; 48(2):179–182. DOI: 10.1016/j.amepre.2014.08.032 [PubMed: 25442225]
20. Marcus BH, Dunsiger SI, Pekmezi DW, et al. The Seamos Saludables study: a randomized controlled physical activity trial of Latinas. Am J Prev Med. 2013; 45(5):598–605. DOI: 10.1016/j.amepre.2013.07.006 [PubMed: 24139773]
21. Holbrook EA, Barreira TV, Kang M. Validity and reliability of Omron pedometers for prescribed and self-paced walking. Med Sci Sports Exerc. 2009; 41(3):670–674. DOI: 10.1249/MSS.0b013e3181886095 [PubMed: 19204582]
22. Tudor-Locke C, Bassett DR Jr. How many steps/day are enough? Preliminary pedometer indices for public health. Sports Med. 2004; 34(1):1–8. [PubMed: 14715035]
23. Peters BP, Heelan KA, Abbey BM. Validation of Omron pedometers using MTI accelerometers for use with children. Int J Exerc Sci. 2013; 6(2)
24. Esliger DW, Tremblay MS. Physical activity and inactivity profiling: the next generation. Can J Public Health. 2007; 98(Suppl 2):S195–S207. [PubMed: 18213949]
25. Gerber M, Barker D, Puhse U. Acculturation and physical activity among immigrants: a systematic review. J Public Health (Bangkok). 2012; 20(3):313–341. DOI: 10.1007/s10389-011-0443-1
26. Geboers B, de Winter AF, Luten KA, Jansen CJ, Reijneveld SA. The association of health literacy with physical activity and nutritional behavior in older adults, and its social cognitive mediators. J Health Commun. 2014; 19(Suppl 2):61–76. DOI: 10.1080/10810730.2014.934933 [PubMed: 25315584]
27. Dominick GM, Dunsiger SI, Pekmezi DW, Marcus BH. Health literacy predicts change in physical activity self-efficacy among sedentary Latinas. J Immigr Minor Health. 2013; 15(3):533–539. DOI: 10.1007/s10903-012-9666-7 [PubMed: 22733230]
28. Tucker P, Gilliland J. The effect of season and weather on physical activity: a systematic review. Public Health. 2007; 121(12):909–922. DOI: 10.1016/j.puhe.2007.04.009 [PubMed: 17920646]
29. Carr LJ, Dunsiger SI. Search query data to monitor interest in behavior change: application for public health. PLoS One. 2012; 7(10):e48158.doi: 10.1371/journal.pone.0048158 [PubMed: 23110198]

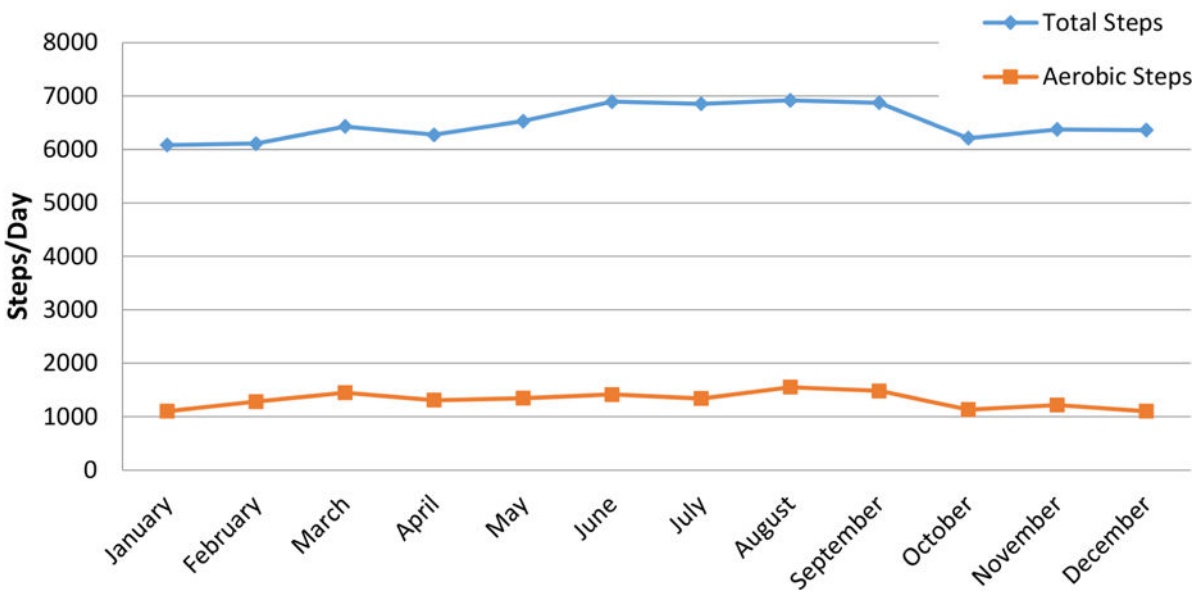

Figure 1.
Mean total steps and aerobic steps by month.

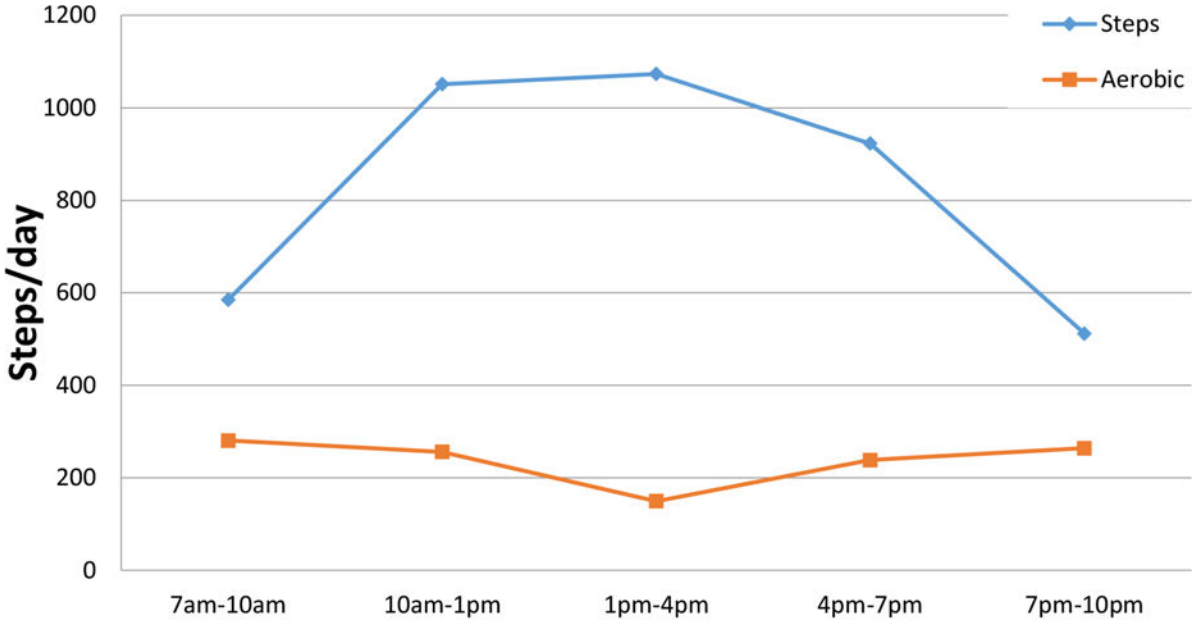

Figure 2.
Mean total steps and aerobic steps by time of day.

Table 1

Mean (SD) for Average Daily Steps, Aerobic Steps, and Aerobic Walking Time by Demographic Variables

	Average steps/day	Average aerobic steps/day	Average aerobic walking time/day
Generational status *			
First	6662 (3882)	1416 (2803)	12.5 (24.8)
Second/third	5879 (3184)	656 (1637)	5.8 (14.3)
Country of origin			
Puerto Rico	7281 (3796)	2123 (3443)	18.1 (28.8)
Dominican Republic	6646 (3568)	1238 (2360)	10.9 (20.6)
Mexico	7098 (3601)	1746 (2394)	15.6 (21.2)
Guatemala	6343 (2862)	1161 (1860)	10.1 (15.5)
Columbia	6787 (4466)	1499 (3192)	13.5 (29.1)
Other	5321 (2701)	630 (1730)	5.6 (14.9)
Educational level *			
≤ High school	7164 (4227)	1908 (3200)	17.0 (28.7)
At least some college	6208 (3489)	972 (2286)	8.5 (19.7)
Employment status *			
Unemployed	6254 (4043)	1407 (2955)	12.7 (26.9)
Full-time	6832 (3857)	1504 (2843)	13.0 (24.3)
Part-time	6809 (3845)	1020 (2036)	9.1 (17.8)
Yearly household income *			
<$10,000	5616 (2959)	762 (1819)	6.8 (16.1)
$10,000–$20,000	7242 (4461)	1621 (3263)	14.6 (29.8)
$20,000–$30,000	7137 (4055)	2178 (3184)	19.0 (27.7)
$30,000–$40,000	5745 (2835)	788 (1632)	7.1 (14.6)
$40,000–$50,000	7322 (4070)	798 (1653)	7.0 (14.3)
$50,000+	6802 (3887)	2172 (3905)	17.6 (31.5)
Do not know	6701 (3514)	1354 (2350)	12.1 (20.9)
Marital status *			
Single	8548 (5376)	2333 (4158)	21.4 (38.5)
Divorced	6316 (3307)	1056 (1962)	9.5 (17.5)
Separated	6694 (3698)	1434 (2703)	12.8 (14.0)
Widowed	5069 (2275)	1296 (2156)	12.1 (19.2)
Married	6416 (3553)	1305 (2588)	11.3 (22.0)
Living with partner	5635 (3105)	823 (1932)	7.4 (17.3)
Health literacy *			
Inadequate (0–16)	4491 (1630)	862 (1262)	7.2 (10.6)
Adequate (17–22)	7095 (3944)	1942 (2695)	16.9 (23.4)
Functional (23–36)	6573 (3834)	1306 (2744)	11.6 (24.3)

* $P < .001$ for between group comparison.

Table 2

Mean (SD) for Total Steps, Aerobic Steps, and Aerobic Walking Time by Year, Season, Weekday/Weekend, Day of Week, and Time of Day

	Total steps	Aerobic steps	Aerobic walking time
Annual	6509 (3799)	1304 (2687)	11.5 (23.7)
Season *			
Summer	6923 (3893)	1473 (2744)	13.0 (24.0)
Spring	6542 (3571) *	1377 (2733)	12.2 (24.1)
Fall	6368 (3727) *	1172 (2577) *	10.3 (22.6) *
Winter	6135 (3771) *	1165 (2665) *	10.3 (23.7) *
Weekday type *			
Weekday	6636 (3797)	1384 (2723)	12.1 (23.9)
Weekend	6098 (3775) *	1048 (2550) *	9.4 (22.8) *
Day of week			
Sunday	4806 (3110)	1040 (2571)	9.3 (23.1)
Monday	5740 (4000)	1434 (2713)	12.6 (23.9)
Tuesday	5706 (3935)	1466 (2768)	12.9 (24.3)
Wednesday	5586 (3887)	1382 (2718)	12.2 (24.0)
Thursday	5667 (3955)	1408 (2770)	12.4 (24.3)
Friday	5779 (4072)	1235 (2641)	10.9 (23.3)
Saturday	5556 (3709)	1055 (2533)	9.4 (22.5)
Time of day			
Early morning (7AM to 10 AM)	1043 (1466)	280 (11650	–
Late morning (10 AM to 1 PM)	1415 (1389)	255 (1043)	–
Early afternoon (1 PM to 4 PM)	1350 (1140)	149 (750)	–
Late afternoon (4 PM to 7 PM)	940 (1374)	238 (991)	–
Evening (7 PM to 10 PM)	940 (1374)	263 (1112)	–

* $P < .001$ for between group comparison.

Table 3

Stratification of Days by Step Indices and Aerobic Walking Time

	Percent of all days
Step indices (% days)	
Sedentary (<5000 steps/day)	42.1%
Low active (5000–7499 steps/day)	26.8%
Somewhat active (7500–9999 steps/day)	13.9%
Active (10,000–12,499 steps/day)	9.7%
Highly active (≥12,500 steps/day)	7.5%
Walking time indices (% days)	
Aerobic walking time (<10 minutes)	71.8%
Aerobic walking time (10–29 minutes)	11.8%
Aerobic walking time (30+ minutes)	16.4%