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ORIGINAL RESEARCH

Income Differences in Perceived Neighborhood Environment Characteristics Among African American Women

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Abstract: Perceptions of neighborhood attributes for physical activity may be influenced by individual level income. This study examined differences in perceptions of neighborhood attributes for walking and bicycling in high and low income African American women. African American women (n = 388) aged 20–65 years completed the International Physical Activity Prevalence Study's Environmental Survey Module. Independent *t*-tests determined differences in perceptions of neighborhood attributes by income group. Principal component factor analysis explored differences in factor structure for survey items. Low income African American women perceived their neighborhood as being less safe with regard to crime and traffic, having fewer free recreational opportunities, and having more public transportation stops nearby. Survey items weighed differently on each factor between income groups. Household income should be taken into consideration when interpreting perceptions of neighborhood for physical activity in African American women.

Keywords: environment design, exercise, income, African American, female

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Introduction

Physical inactivity contributes to obesity and chronic diseases such as diabetes, heart disease, and some cancers.[1] Despite these known consequences and the development of national guidelines for physical activity,[2] most adults do not achieve the recommended amount of physical activity.[3,4] Population subgroups such as ethnic minorities, women, and those of low socioeconomic status (SES; income or education status) demonstrate disproportionally lower levels of physical activity than their white, male and high SES counterparts.[5–7]

Ecologic models posit that individual, social, and environmental factors support behaviors such as physical inactivity.[8,9] The Ecologic Model of Physical Activity (EMPA) takes into account the direct and indirect influence that the environment has on physical activity.[9] Thus, components of the neighborhood environment, including sidewalks, land use diversity, or parks and other recreational facilities are believed to have an integral role in the decision to do physical activity. These components may also moderate or buffer more distal factors such as income or education that are thought to influence physical activity. Population level data show that those of lower SES are less likely to do physical activity, and the neighborhood context has been shown to be a considerable factor in this disparity.[6,10]

Recent studies have shown that some low SES neighborhoods have a greater quantity of physical activity resources such as parks and sidewalks available.[11–15] These studies suggest that for residents of low SES neighborhoods, the objective availability of physical activity resources may not be the most influential factor in physical activity participation. Instead, perceptions and awareness of resources and perceived desirability, utility, functionality, and safety of these resources[10,12,16] may contribute to physical activity levels.[11] For example, low income neighborhoods may have facilities, parks, or walkable streets, but neighborhood residents may not view them as accessible, safe, or well maintained.[14,16,17]

Certain population subgroups may perceive characteristics of the neighborhood or built environment in a different way. Perceptions of the environment for physical activity have been shown to differ based on gender,[18] age,[16,19] ethnicity,[20] and, recently, neighborhood income level.[21] Sallis and colleagues examined neighborhood income differences in perceived neighborhood environment attributes measured using the Neighborhood Environment Walkability Scale (NEWS), and found income discrepancies on 10 out of 15 items.[21] Although this study showed differences in perceptions at the neighborhood income level, it is not clear how individual level income status can influence perceptions of one's neighborhood for physical activity. Income disparities in perceptions of neighborhood environment are important because objective built environment attributes, such as walkability, may interact with subjective factors, such as perceived neighborhood safety, and may be more pronounced in those of low income status. The interaction of walkability and perceiving one's neighborhood as unsafe for walking may reduce the beneficial effects associated with walkability, which can, in turn, inhibit physical activity. For example, a study by McAlexander and colleagues found that greater sidewalk connectivity predicted higher BMI and percent body fat in low income African Americans.[13] Perceived fear of crime may have discouraged these residents to utilize neighborhood sidewalks for physical activity. Understanding individual income differences in perceptions of neighborhood characteristics for physical activity may contribute to a greater understanding of the disparities in physical activity and obesity in low income groups. Previous studies have not examined individual level household income differences in perceptions of the neighborhood environment using the International Physical Activity Prevalence Study (IPS) Environmental Module, or in the vulnerable, gender, and ethnic specific group of African American women.

Research question and hypothesis

The aims of this study were to (1) examine individual level income differences in African American women's perceptions of neighborhood environment attributes for walking and bicycling, and (2) compare the results of principal component factor analyses in high and low income African American women for a questionnaire used to assess perceptions of neighborhood environmental factors for walking and bicycling. It was hypothesized that (1) low income women would perceive their neighborhood as more walkable and less safe, and (2) the principal component factor analyses would yield different results in the same questionnaire completed by high and low income African American women.

Method

Parent studies

This study conducted a secondary data analysis on perceptions of the neighborhood environment for walking and bicycling from the Health Is Power (HIP) study (National Institutes of Health, R01 CA109403), and Healthful Options Using Streets and Transportation in Our Neighborhoods (HOUSTON) project (Robert Wood Johnson Foundation, Active Living Research, CFP3 52468). HIP was a multi-site longitudinal study from 2006 to 2008 that was designed to increase physical activity and improve dietary habits in African American and Hispanic or Latina women in Houston and Austin, Texas. The HOUSTON project was a three year cross-sectional study from 2005 through 2008 that was designed to identify and assess environmental correlation of walking in neighborhoods by African Americans who reside in public housing. The HIP and HOUSTON studies were approved by the University of Houston's Committee for the Protection of Human Subjects, and participants gave their written informed consent to participate prior to data collection. Investigators certified that all applicable institutional and governmental regulations concerning the ethical use of human volunteers were followed during the investigation.

Participants

Data from a total of 252 African American women from the HIP project and 136 African American women from the HOUSTON project were included in the current study. These studies were chosen for secondary data analysis in the current study because in both studies, participants: (1) self-identified as black or African American; (2) were between the ages of 18 and 89 years old; (3) were able to read, speak, and write in English; (4) were not pregnant or planning to become pregnant within the next 12 months; (5) were Harris County residents; (6) were not planning on moving in the next 12 months; and (7) free from conditions that could be aggravated by participation in physical activity. HIP participants from Houston were recruited from various neighborhoods in Harris County and were included in this study because all had an annual household income above the 2007 Federal Poverty Level and the majority (82.6%) were more than 201% above the 2007 Federal Poverty Level. All HOUSTON participants were recruited

from 12 public housing developments in Houston, Texas. HOUSTON participants were included in this study because in order to qualify for public housing, residents had to have met the 2006 US Department of Health and Human Service's Poverty guidelines of an annual household income of $19,350 or less per year for a family of four (Harris County Housing Authority). The participants from each study provided a unique and important contribution to the current study, as income level within each study group was relatively homogenous, yet vastly different between groups. Participants from the HOUSTON study were categorized as low-income, and participants from the HIP study were categorized as high-income.

Measures

Individual household income was based on total annual income adjusted for household size. The Maternal and Infant Health Assessment (MIHA) questionnaire was used to collect individual household income information.[22] Participants were asked: "What was your total family income in the most recent tax year before taxes?" They were instructed to check one box that corresponded to the range of income that best represented their total family income, including the responder's income, the income of their husband or partner (if living with them in the most recent year), and that of their children. Income range categories were: $0 to $12,000, $12,001 to $16,000, $16,001 to $19,000, $19,001 to $22,000, $22,001 to $25,000, $25,001 to 28,000, $28,001 to $31,000, $31,001 to $38,000, $38,001 to $44,00, $44,001 to $47,000, $47,001 to $50,000, $50,001 to $57,000, $57,001 to $63,000, $63,001 to $66,000, $66,001 to $76,000, $76,001 to $85,000, $85,001 to $88,000, $88,001 to $101,000, $101,001 to $114,000, and $114,001 or more. Participants were also asked how many people lived on this income for the past year. For analyses, household income was standardized for a family of four and calculated as a percentage of the 2007 Federal Poverty Level. Income categories were 0%–100%, 101%–200%, 201%–300%, 301%–400%, and 401% or greater than the 2007 Federal Poverty Level for a family of four. Median household income at the census block group (neighborhood) level is described below to illustrate the unique contribution of individual income beyond neighborhood income status. Five year estimates of median neighborhood household

income was obtained from the 2006–2010 American Community Survey.

The IPS Environmental Module was used to assess perceived neighborhood environment. This module has been previously assessed for reliability and validity,[23] and is available for free online.[24] This instrument consists of 15 questions that ask participants their level of agreement with questions about perceptions of their neighborhood on a scale of 1–4 [Strongly disagree (1), Somewhat disagree (2), Somewhat agree (3), Strongly agree (4)]. One question which asks about the main type of housing in the neighborhood, and one question which asks how many working motor vehicles are present in the household were not included in analyses because these questions did not ask about participant perceptions of their neighborhood for walking or bicycling.

Analyses

All data were screened, entered, and verified using standardized quality control procedures. Analyses were conducted using PASW Statistics (version 18.0, SPSS Inc., Chicago, IL). Descriptive statistics and differences between high and low income groups were calculated for sociodemographic variables, BMI, and each perceived environment item from the IPS Environmental Module. Differences between high and low income groups were calculated using independent t-tests ($P < 0.05$). Where participants were missing data, pairwise deletion was used for complete case analyses.

A principal component factor analysis was conducted on 15 of the 17 items of the IPS Environmental Module to understand the structure of the survey items that are highly correlated with one another in high and low income participants. Two items that were excluded from the factor analysis did not use the same scale as the remaining 15 questions. Factors with eigenvalues of ≥1 were extracted and Varimax rotation was used to identify simple, orthogonal factor structure.

Results
Descriptive characteristics

Participants in both groups were middle aged (M high income = 44.8 ± 9.4; M low income = 43.3 ± 16.1) and obese (M BMI high income = 35.0 ± 9.4 kg/m²; M low income = 33.0 ± 8.9 kg/m²). The average individual

household income of HIP (high income) participants was 301%–400% of the 2007 Federal Poverty Level for a family of four, compared to HOUSTON (low income) participants who had an average individual household income that was 101%–300% of the 2007 Federal Poverty Level for a family of four ($P < 0.001$). The median or most common household income for the high income group was 401% or greater than the 2007 Federal Poverty Level for a family of four (54.5% of participants), compared to a median household income of 0%–100% of the 2007 Federal Poverty Level for a family of four in the low income group (60.5% of participants). The majority of the participants in the high income group had graduated from college (53.4%) compared to only 4.5% of participants in the low income group ($P < 0.001$). Average median household income at the neighborhood level (census tract) was similar in both groups; \$39,460 ± 15,241 in the high income group and \$32,297 ± 13,511 in the low income group.

Income differences in perceived environment questionnaire items

Independent t-tests revealed significant income differences for five items on the perceived environment questionnaire. Low income African American women were more likely to perceive that their neighborhood had a transit stop within a 10–15 minute walk from their home [t(385) = −4.05, $P < 0.001$], a crime rate that made it unsafe to walk during the day [t(361) = −4.63, $P < 0.001$] and at night [t(381) = −2.76, $P < 0.01$], and so much traffic on the streets that made it difficult or unpleasant to walk [t(384) = −2.86, $P < 0.01$]. High income women were more likely to perceive their neighborhood to have several free or low cost recreation facilities [t(382) = 2.49, $P < 0.05$]. Average participant ratings and differences between high and low income groups for each perceived environment questionnaire item are displayed in Table 1.

Factor analysis

A principal component factor analysis was conducted separately for high and low income groups on 15 of the 17 items on the IPS Environmental module. The factor analyses revealed a four factor solution for high income women accounting for 57.1% of the variance and a five factor solution for low income women accounting for 60.9% of the variance. Only variables

Table 1. Income differences on items from the IPS environmental module.

Perceived environment item	High income Mean (SD)	Low income Mean (SD)
2. Many shops, stores, markets or other places to buy things I need are within easy walking distance of my home.	2.4 (1.3)	2.5 (1.1)
3. It is within a 10–15 minute walk to a transit stop (such as bus, train, trolley, or tram) from my home.	2.9 (1.4)	3.5 (0.9)***
4. There are sidewalks on most of the streets in my neighborhood.	3.4 (1.0)	3.5 (1.0)
5. There are facilities to bicycle in or near my neighborhood, such as special lanes, separate paths or trails, shared use paths for cycles and pedestrians.	2.7 (1.4)	2.7 (1.5)
6. My neighborhood has several free or low cost recreation facilities, such as parks, walking trails, bike paths, recreation centers, playgrounds, public swimming pools, etc.	3.3 (0.9)	3.0 (1.2)*
7. The crime rate in my neighborhood makes it unsafe to go on walks at night.	2.7 (1.3)	3.1 (1.2)**
8. There is so much traffic on the streets that it makes it difficult or unpleasant to walk in my neighborhood.	2.2 (1.2)	2.6 (1.3)**
9. I see many people being physically active in my neighborhood doing things like walking, jogging, cycling, or playing sports and active games.	3.0 (0.9)	2.9 (1.2)
10. There are many interesting things to look at while walking in my neighborhood.	2.5 (1.1)	2.4 (1.3)
11. How many motor vehicles in working order (eg, cars, trucks, motorcycles) are there at your household?	1.9 (0.9)	1.3 (7.7)
12. There are many four-way intersections in my neighborhood.	3.0 (1.0)	3.1 (1.3)
13. The sidewalks in my neighborhood are well maintained (paved, with few cracks) and not obstructed.	3.0 (1.1)	2.8 (1.2)
14. Places for bicycling (such as bike paths) in and around my neighborhood are well maintained and not obstructed.	2.8 (1.4)	2.7 (1.3)
15. There is so much traffic on the streets that it makes it difficult or unpleasant to ride a bicycle in my neighborhood.	2.5 (1.2)	2.7 (1.2)
16. The crime rate in my neighborhood makes it unsafe to go on walks during the day.	1.9 (1.1)	2.4 (1.1)***
17. There are many places to go within easy walking distance of my home.	2.7 (1.1)	2.65 (1.2)

Notes: *Significantly different from high income at $P < 0.05$; **$P < 0.01$; ***$P < 0.001$; [a]Scoring for each item: Strongly Disagree (1), Somewhat Disagree (2), Somewhat Agree (3), Strongly Agree (4).

with factor loadings of 0.30 or greater were included in a factor. Individual items loaded differently on each factor between high and low income groups. The rotated factor loadings for high and low income African American women are displayed in Table 2.

Discussion

The results of this study provide support for income differences in perceptions of the neighborhood environment for physical activity in African American women. This study found that low income African American women were more likely to perceive that their neighborhood had a transit stop within a 10–15 minute walk from their home, a crime rate that made it unsafe to walk during the day and at night, and traffic on the streets that made it difficult or unpleasant to walk. High income women were more likely to perceive their neighborhood to have several free or low cost recreation facilities. This is consistent with previous studies which have reported

a greater likelihood of low income neighborhood residents reporting crime or feeling unsafe,[25,26] greater residential density in low income urban neighborhoods,[11,25,26] and fewer perceived opportunities for physical activity in lower income neighborhoods compared to higher income neighborhoods.[10] Our findings are also consistent with the study by Sallis and colleagues which found that residents from high-income neighborhoods perceived greater safety from crime and traffic and greater access to recreation facilities.[21]

The exploratory factor analysis conducted on the IPS Environmental Module revealed different factor structures for high and low income women. Responses to individual items may be produced by different constructs in different populations, making it difficult to interpret responses across groups. This means that an item is correlated with a different set of items in each income group, and therefore identifying an underlying structure of factors, such as safety or

Table 2. Comparison of factor loadings for high and low income African American women.

Questionnaire item	High income				Low income				
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
There is so much traffic on the streets that it makes it difficult or unpleasant to walk in my neighborhood	**0.784**					**0.665**			
The crime rate in my neighborhood makes it unsafe to go on walks at night	**0.778**					**0.682**			0.314
There are many places to go within walking distance	**0.757**						**0.765**		
The crime rate in my neighborhood makes it unsafe to go on walks during the day	**0.628**					**0.706**			
There are facilities to bicycle in or near my neighborhood		**0.733**			0.316			**0.676**	
There is so much traffic on the streets that it makes it difficult or unpleasant to ride a bicycle in my neighborhood		**0.711**	0.406			**0.764**			
My neighborhood has several free or low cost recreation facilities		**0.663**			**0.648**				
There are many interesting things to look at while walking in my neighborhood	−0.366	**0.634**	0.315		**0.544**		0.427		
I see many people being physically active	−0.398	**0.541**			**0.602**			0.409	
There are sidewalks on most of the streets in my neighborhood			**0.886**		0.350			**0.460**	
Places for bicycling are well maintained			**0.831**		**0.789**				
The sidewalks in my neighborhood are well maintained				**0.615**	**0.677**				
There are many four way intersections in my neighborhood				−0.554				**0.738**	
Many shops and stores within walking distance of home		0.369		**0.547**			**0.839**		
It is within a 10–15 minute walk to a transit stop	0.336			**0.530**					**0.881**

Notes: [a]Bold font indicates the greatest factor loading for a questionnaire item; [b]all factor loadings of 0.30 or greater are displayed.

walkability, would include different items depending on the income level of the respondent. For example, the IPS Environmental Module item "there is so much traffic it's difficult or unpleasant to ride a bike" in the high income group is associated with other bicycle questions and recreation related items, which would seem to indicate a factor specific to leisure biking (i.e. Not for transportation). Alternatively, in the low income group this item is associated with the safety from crime items and the "traffic and walking" item which may indicate a factor related to safety. The item response in the high income group appears to depend on perceptions of the neighborhood environment's suitability for leisure-time biking, whereas the response in the low income depends on the perceptions of neighborhood safety. This introduces some difficulty in interpretation of the item responses without knowing the respondent's income level. This information is important for understanding IPS Environmental Module response patterns and indicates the importance of considering sociodemographic characteristics for accurate interpretation of item responses. The absence of factor invariance between high and low income African American women suggests the need for future research to examine the stability of the constructs evaluated by this perceived environment questionnaire across various sociocultural groups.

Measuring income at the individual (household) level as opposed to the neighborhood level contributes an interesting interpretation for these findings. The effect of neighborhood income or SES on health behaviors such as physical activity has been well established,[27] and the results of this study indicate that perceptions of one's neighborhood for physical activity may also be impacted by individual income. Participants from the low income group were residents of government sponsored public housing developments, so they were required to have an individual household income below poverty level. However the housing developments were located in diverse neighborhoods with neighborhood level (census tract) median household income ranging from $9,926 to $57,618. This neighborhood level income range was comparable to the range for the high income participants ($13,421 to $97,436), but participants with a lower individual income still perceived their neighborhood as less safe to walk due to crime or traffic, less accessible to free or low cost recreation facilities, and having a

transit stop nearby. Perhaps residents of public housing developments perceived their 'neighborhood' as only their immediate surrounding within the housing development.[28] A number of other income-related issues may have contributed. For example, individual income may have impacted the perception of available transit stops if low income individuals did not have access to personal motorized vehicles and were therefore more likely to actually utilize public transportation.

Strengths of this study include a sizeable sample of African American women, an understudied and vulnerable population, the direct comparison of high and low income samples and the application of widely used and validated questionnaires to measure individual income (MIHA) and perceptions of the neighborhood environment for physical activity (IPS Environmental Module). A limitation to these findings in the comparisons of responses on individual IPS items between high and low income participants are unadjusted for potential confounders. Although outside the scope of this study, the inclusion of objective measures of neighborhood environment for physical activity may have added to the interpretation of the findings. The concordance between perceived and objective measures of the built environment for physical activity would have indicated how accurately participants perceived their neighborhood for physical activity, and whether this concordance was different for high versus low income participants.

Individual income level should be taken into consideration when examining perceptions of neighborhood environment for walking and bicycling in African American women, as these perceptions were different for high and low income groups. Further studies are needed to explore measurement issues related to income differences in the IPS Environmental Survey Module. Future research should account for income differences in perceptions, and potentially the accuracy of perceptions of the built environment when addressing neighborhood barriers and support for physical activity in African American women. Understanding how income differences in neighborhood perceptions may influence the decision to be physically active is important in order to encourage or support adoption and maintenance of physical activity in this population.

Author Contributions

Conceived and designed the experiments: REL, HJAL. Analysed the data: HJAL. Wrote the first draft of the manuscript: HJAL. Contributed to the writing of the manuscript: All authors contributed to the writing of the manuscript. Agree with manuscript results and conclusions: All authors agree with the manuscript results and conclusions. Jointly developed the structure and arguments for the paper: HJAL, DPO, REL. Made critical revisions and approved final version: All authors reviewed and approved of the final manuscript.

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References

1. Warburton D, Nicol C, Bredin S. Health benefits of physical activity: the evidence. *CMAJ*. 2006;174(6):801–9.
2. USDHHS. Physical Activity Guidelines for Americans. 2008; http://www.health.gov/PAGuidelines/default.aspx.
3. Macera C, Ham S, Yore M, et al. Prevalence of physical activity in the United States: Behavioral Risk Factor Surveillance System, 2001. *Prev Chronic Dis*. 2005;2(2):A17.
4. Li C, Balluz LS, Okoro CA, et al. Surveillance of certain health behaviors and conditions among states and selected local areas—Behavioral Risk Factor Surveillance System, United States, 2009. *MMWR Surveill Summ*. 19 2011;60(9):1–250.
5. CDC. Behavioral Risk Factor Surveillance System Survey Data. 2008; http://www.cdc.gov/brfss/technical_infodata/quality.htm.
6. Crespo CJ, Smit E, Andersen RE, Carter-Pokras O, Ainsworth BE. Race/ethnicity, social class and their relation to physical inactivity during leisure time: results from the Third National Health and Nutrition Examination Survey, 1988–94. *Am J Prev Med*. 2000;18(1):46–53.
7. Trost SG, Owen N, Bauman AE, Sallis JF, Brown W. Correlates of adults' participation in physical activity: review and update. *Med Sci Sports Exerc*. 2002;34(12):1996–2001.
8. Sallis JF, Owen N. *Ecological Models*. Vol 2nd ed. San Francisco: Jossy-Bass; 1997.
9. Spence JC, Lee RE. Toward a comprehensive model of physical activity. *Psychology of Sport and Exercise*. 2003;4:7–24.
10. Lee RE, Cubbin C, Winkleby M. Contribution of neighbourhood socioeconomic status and physical activity resources to physical activity among women. *J Epidemiol Community Health*. 2007;61(10):882–90.
11. Cutts BB, Darby KJ, Boone CG, Brewis A. City structure, obesity, and environmental justice: an integrated analysis of physical and social barriers to walkable streets and park access. *Soc Sci Med*. 2009;69(9):1314–22.
12. Heinrich KM, Lee RE, Suminski RR, et al. Associations between the built environment and physical activity in public housing residents. *Int J Behav Nutr Phys Act*. 2007;4:56.
13. McAlexander KM, Banda JA, McAlexander JW, Lee RE. Physical activity resource attributes and obesity in low-income African Americans. *J Urban Health*. 2009;86(5):696–707.
14. Lee RE, Booth KM, Reese-Smith JY, Regan G, Howard HH. The Physical Activity Resource Assessment (PARA) instrument: evaluating features, amenities and incivilities of physical activity resources in urban neighborhoods. *Int J Behav Nutr Phys Act*. 2005;2:13.
15. Adamus HJ, Mama SK, Sahnoune I, Lee RE. Evaluating the Quality and Accessibility of Physical Activity Resources in Two Southern Cities. *Am J Health Promot*. 2012;27(1):52–4.
16. Eyler AA, Matson-Koffman D, Young DR, et al. Quantitative study of correlates of physical activity in women from diverse racial/ethnic groups: The Women's Cardiovascular Health Network Project—summary and conclusions. *Am J Prev Med*. 2003;25(3 Suppl 1):93–103.
17. Lee RE, Reese-Smith J, Regan G, et al. Promoting walking in high and low supportive urban neighborhoods. *Int J Beh Med*. 2004;11:S294.
18. Garcia Bengoechea E, Spence JC, McGannon KR. Gender differences in perceived environmental correlates of physical activity. *Int J Behav Nutr Phys Act*. Sep 13, 2005;2:12.
19. Shigematsu R, Sallis JF, Conway TL, et al. Age differences in the relation of perceived neighborhood environment to walking. *Med Sci Sports Exerc*. 2009;41(2):314–21.
20. Hooker SP, Wilson DK, Griffin SF, Ainsworth BE. Perceptions of environmental supports for physical activity in African American and white adults in a rural county in South Carolina. *Prev Chronic Dis*. 2005;2(4):A11.
21. Sallis JF, Slymen DJ, Conway TL, et al. Income disparities in perceived neighborhood built and social environment attributes. *Health Place*. 2011; 17(6):1274–83.
22. California Department of Public Health. Maternal and Infant Health Assessment (MIHA) Survey. 2008; http://www.cdph.ca.gov/data/surveys/Pages/MaternalandInfantHealthAssessment%28MIHA%29 survey.aspx.
23. Alexander A, Bergman P, Hagstromer M, Sjostrom M. IPAQ environmental module; reliability testing. *J Public Health*. 2006;14:76–80.
24. International Physical Activity Prevalence Study. Self-Administered Environmental Module. 2002; http://www-rohan.sdsu.edu/faculty/sallis/IPAQIPS.pdf.
25. Loukaitou-Sideris A, Eck JE. Crime prevention and active living. *Am J Health Promot*. 2007;21(Suppl 4):380–9, iii.
26. Winkleby MA, Cubbin C. Influence of individual and neighbourhood socioeconomic status on mortality among black, Mexican-American, and white women and men in the United States. *J Epidemiol Community Health*. 2003; 57(6):444–52.
27. Lee RE, McAlexander KM, Banda JA. *Reversing the Obesogenic Environment*. Champagne, IL: Human Kinetics; 2011.
28. Eugeni ML, Baxter M, Mama SK, Lee RE. Disconnections of African American public housing residents: connections to physical activity, dietary habits and obesity. *Am J Community Psychol*. 2011;47(3–4):264–76.