



RESEARCH BRIEF

Promoting Active Living in Rural Communities

INTRODUCTION

Rural children and adults have significantly higher rates of obesity than their urban counterparts,¹⁻⁵ even after accounting for differences such as socioeconomic factors, eating behaviors, and physical activity.^{4,5} Higher rates of overweight and obesity among rural residents, even after accounting for these demographic and behavioral factors, suggests that rural environments themselves may somehow promote obesity.^{6,7}

Based on recent national body mass index (BMI) data, the obesity rate for rural children ages 2–18 is 22 percent, compared to 17 percent for urban children.⁵ Among children, rural black children have the highest risk of all subgroups, with a higher obesity rate than both rural white children⁵ and urban black children.⁸ Among adults, 40 percent of rural adults are obese, compared to 33 percent of urban adults, with rural black adults having higher rates of obesity than urban black adults.⁴ Hispanic populations, especially those of Mexican heritage living in rural areas along the U.S.–Mexico border and in similar new-immigrant communities across the U.S., are also disproportionately burdened by high rates of obesity.^{9,10}

Studies on whether urban residents are less active than rural residents have yielded mixed results; differences across geographic regions and with various methods of measuring physical activity illustrate the complexity of understanding how and where rural residents are physically active.

Because rural residents make up 15 percent of the U.S. population,¹¹ and face health challenges including high obesity rates, high levels of poverty, and limited access to healthcare providers and services, this population has been identified by some researchers as a “priority population” in the fight to reduce obesity and improve health overall.^{12, 13}

There is no single definition of rural, but rather a continuum that reflects the diverse geographies of rural communities, and several rural definitions have been created to address rural concerns and needs.¹⁴ Recent demographic shifts in rural communities, such as the increase of Hispanic and Latino populations and older adults,^{15, 16} and regional cultural differences are also reminders that not all rural communities are the same and that there is no “one-size-fits-all” approach to addressing rural obesity.¹²

This brief summarizes current research on elements of the rural built environment that may be related to obesity or physical activity. Much of this research is qualitative in nature, including evidence and conclusions drawn from rural focus groups, PhotoVoice studies, policy statements, observations from the field, and lessons learned from rural active living interventions.

THE EVIDENCE

- **It is not clear if rural-urban differences in obesity rates are due to differing physical activity levels.** Some studies have indicated that rural children engage in less physical activity than urban children,^{17, 18} some have reported inconsistent evidence,¹⁹ and some show no overall rural-urban differences in frequency of physical activity.^{5, 8, 20} Rural adults were less active than urban adults when activity levels were objectively measured, but when subjective, self-reported activity levels were used, rural adults were more active than urban adults, especially in household- and transportation-related physical activity.²¹ In Southern regions of the U.S., rural adults were less active than urban adults, however the opposite has been reported in the Western U.S.²²
- **Important barriers to physical activity in rural communities may include isolation, lack of transportation options, lack of access to places with physical activity opportunities, climate and terrain, cost and safety fears such as high traffic speeds, the threat of loose dogs and wild animals, crime concerns, and lack of sidewalks and lighting.**^{12, 23-34}
- **Since active transportation (walking and biking to destinations) is often difficult to achieve in dispersed rural and remote areas where residents live far from schools, worksites and other common destinations, there is a need for environments that support active recreation, even if residents must drive to get to them.** Safe playgrounds, parks, bike paths, trails and other recreational facilities can offer rural residents opportunities to be physically active. Efforts should be made to ensure these amenities are accessible, well-marked, adequately maintained, clear of snow, and that they provide adequate shade.^{12, 35-37}
 - In a cross-sectional study of rural youth in two rural Georgia counties, the odds of youth participating in physical activity increased by 20 percent when youth had access to one physical activity area (i.e. a park, recreation center, school grounds or a yard). Youth reporting access to multiple physical activity areas were twice as likely to be physically active than youth with no access to physical activity areas.²⁷
- **Because of rural communities’ more dispersed population, improvements to the built environment may affect relatively few people.** Successful models for active living in these dispersed rural communities should prioritize community and school programs and policies that promote physical activity.^{12, 35, 36, 38}
- **For larger rural communities that have a traditional downtown center and/or densely populated neighborhoods, urban-based solutions for increasing active living may be applicable.** In these cases, rural Smart Growth and Complete Streets strategies can be used to support safe travel by foot, bicycle or vehicle. These strategies can be used to improve existing places, or create new places that attract residents, businesses, and visitors. Improvements such as street paving and lining, wider street shoulders, sidewalk upgrades, crosswalks, lighting, pedestrian signs, and bicycle features can help calm traffic and improve safety and accessibility for pedestrians, cyclists and vehicles.^{39, 40}
- **Some rural and remote communities may not have a sufficient tax base to support new or existing parks, recreational facilities, and designated open space.**¹² Unincorporated rural communities may also lack a central organizing body to govern the care and maintenance of public spaces.³⁶ However, these communities may be able share facilities and staff with neighboring communities in a regionalized approach; create activity centers in existing buildings, such as hospitals, senior centers, and businesses; enter into shared-use agreements with schools, community non-profits, and faith organizations; and link nearby communities with trails between rural routes and downtown areas.⁴⁰⁻⁴²

- **Because of limited resources, few physical activity facilities, and long travel distances in many rural areas, schools may be one of the only locations outside of the home for many rural children to be regularly active.** Creative, affordable, before- and after-school, weekend and summer physical activity programming on school grounds can provide important opportunities for children, families, and community members to be physically active. Interventions targeting physical activity areas in schools, such as increasing playground space and improving equipment, are important given the large amount of time children spend in the school setting. Shared-use agreements between schools and communities can offer opportunities for physical activity without the need to build new infrastructure.⁴³⁻⁴⁶ Safe Routes to School programs adapted for rural areas (for example, with centralized drop-off locations within walking distance of schools, for adult-supervised walking school buses) can give rural children who live far away a chance join those who live close enough to walk or bike to school.⁴⁷
- **Transportation options for children, especially school buses, vans and ride-shares scheduled for participants in after-school activities, can potentially expand opportunities for rural children living in remote areas to take advantage of after-school physical activity programming.**^{12, 48}
- **For adults and families, existing community centers and resources such as churches and worksites can help encourage both planned and spontaneous physical activity.**^{49, 50}
 - Data from a cross-sectional survey of adults in rural Georgia revealed that those reporting high levels of physical activity also tended to report significantly more activity programs and facilities at their church than those with low levels of physical activity. Support from others and companionship for physical activity, when occurring in a participant's church community, were associated with more walking and total physical activity. Social support for physical activity at work was modestly associated with physical activity.⁴⁹
- **Interventions designed to provide social support and a safe, walkable environment may help increase physical activity in rural communities.**^{32, 51, 52}
 - In a study of rural mothers in New Hampshire and Vermont, the most commonly cited intrinsic barriers to engaging in physical activity were lack of time (83% reported it prevented physical activity), lack of self-discipline (74%), and lack of energy (70%). Researchers found that these three factors were also significantly related to rural mothers' self-reported physical activity levels. Interventions supporting environments that promote walking and biking for transportation in

rural communities (which often lack active-transport infrastructure) may help rural mothers overcome some of these barriers, by making physical activity a "default option" for residents.⁵¹

- In a sample of rural older adults in North Carolina, those who approached recommended levels of physical activity were significantly more likely to report that they felt safe in activity environments, had someone to be physically active with, lived within walking distance of a park, and had an activity area, such as a community park, close to home.⁵²

- **When identifying barriers to and opportunities for active living in rural communities, it is important to bring many different voices to the table.** For strong public participation and buy-in, collaboration and input are needed from community members and leaders, partners, and stakeholders.⁵³⁻⁵⁵ This collaboration might include mayors, town planners, public works departments, recreation department staff, school officials, church leaders, business owners, healthcare and public health professionals and advocates, architects, parents, senior citizens, and youth. These broad-based partnerships can help address rural-specific barriers to activity such as cultural differences, smaller population size, limited human capital, and the challenge of connecting social and economic policies to health outcomes.⁵⁴

CONCLUSIONS AND POLICY IMPLICATIONS

- A major difference between urban and rural environments is that regular active transportation may be an unrealistic option for some rural residents. This increases the importance of active recreation opportunities in rural communities, and the need for investment in recreation amenities and transport options to help residents get to those amenities.
- Enhancing features of the rural environment, such as playgrounds, parks and recreational facilities, and diminishing barriers, including isolation, climate, safety fears, cost, lack of transportation, and lack of access to physical activity areas, are both key in addressing active living and obesity in rural communities.^{12, 17, 23-27, 34, 36, 48}
- Building infrastructure (e.g., wider paved shoulders along rural roads, and pedestrian crossings) and implementing Complete Streets policies that accommodate the needs of pedestrians and bicyclists can help reduce barriers to being physically active.^{40, 56} An isolated rural road may be a "Complete Street" if it has safe, wide shoulders or foot-paths for walking and biking, while a rural community with denser downtown or residential areas might benefit from more extensive pedestrian and bicycle features, such as sidewalks, bicycle lanes, and other safety features designed for multiple kinds of transportation.

- Especially where resources and budgets are limited, rural communities might consider starting with smaller changes (e.g., repainting existing crosswalks, adding pedestrian signs, updating and promoting Safe Routes to School and shared-use policies, reviewing town-wide snow-removal policies) to build momentum toward larger changes (e.g., widening street shoulders, adding or improving sidewalks, adding physical activity facilities to an existing park or building a new park, budgeting for late school buses). Communities can start by identifying and improving infrastructure and policies that already exist in schools, churches, worksites, and other community resources.
 - Isolation, lengthy travel distances, and lack of transportation opportunities may be the largest barriers to being physically active in many rural areas, especially for those who live too far away to walk to school or work, for children who rely on adults for transportation and for others without access to a car.^{12, 33, 36, 48, 57} Expanding transportation options (e.g. late school buses, vans and ride-shares) can help get rural children and adults to physical activity facilities and programs.
 - Creative, local solutions tailored to specific community culture, geography, climate and needs are necessary when addressing rural active living. Bringing rural community members and stakeholders together can help initiate conversations and positive changes in communities.^{32, 35, 58}
 - It is important to consider the needs of rural subpopulations, including minorities, seniors, individuals with disabilities, children and others when designing environmental, programmatic, and policy changes related to active living.
 - Future rural active living research and interventions should include quantitative measurement and analyses to build a strong, empirical evidence base for future environmental, programmatic, and policy changes for improving rural active living opportunities.
 - Rural-specific measures have been developed and tested for assessing active living supports, barriers, and perceptions. Perceptions of physical activity opportunities are influenced by social-ecological, cognitive, and cultural perspectives and can be measured to understand people's likelihood of using places for physical activity.⁵⁹⁻⁶¹ Using tools that measure active living resources and perceptions can help build the rural active living evidence base.
 - *The Rural Active Living Assessment (RALA) Tools* measure the physical, policy, and programmatic active living environments, while providing opportunities for communities to mobilize and discuss priorities, resources, first steps, and long-term goals.^{35, 58} (To access the RALA Tools, see: <http://activelivingresearch.org/rural-active-living-assessment-rala-tools>.)
 - *The Rural Active Living Perceived Environmental Support Scale (RALPESS)* helps measure perceptions of active living opportunities in rural communities.⁶² (To access the RALPESS, see: <http://activelivingresearch.org/rural-active-living-perceived-environment-support-scale-ralpeess>.)
 - *The Rural Pedestrian Environmental Audit Instrument* measures rural-specific neighborhood domain and walkability scores, as well as self-reported data about perceptions of the neighborhood and physical activity behavior.⁶³
 - *The Pedestrian Environmental Data Scan (PEDS)*, a previously tested instrument for conducting audits of the built environment for physical activity supports, has been modified with a reduced number of items more appropriate for rural settings.⁶⁴ (To access PEDS, see: <http://activelivingresearch.org/pedestrian-environment-data-scan-peds-tool>.)
 - *The PIN3 Neighborhood Audit Instrument* was designed to examine roads and thoroughfares and walkability of neighborhoods in both urban and rural communities.⁶⁵ (To access PIN3, see: <http://activelivingresearch.org/pin3-neighborhood-audit-instrument>.)
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REFERENCES

- 1 Lutfiyya MN, Lipsky MS, Wisdom-Behounek J, Inpanbutr-Martinkus M. Is rural residency a risk factor for overweight and obesity for U.S. children? *Obesity* (Silver Spring). 2007;15(9):2348-56.
- 2 Patterson PD, Moore CG, Probst JC, Shinogle JA. Obesity and physical inactivity in rural America. *J Rural Health*. 2004;20(2):151-9.
- 3 Jackson JE, Doescher MP, Jerant AF, Hart LG. A national study of obesity prevalence and trends by type of rural county. *J Rural Health*. 2005;21(2):140-8.
- 4 Befort CA, Nazir N, Perri MG. Prevalence of obesity among adults from rural and urban areas of the United States: findings from NHANES (2005–2008). *J Rural Health*. 2012;28(4):392-7.
- 5 Davis AM, Bennett KJ, Befort C, Nollen N. Obesity and related health behaviors among urban and rural children in the United States: data from the National Health and Nutrition Examination Survey 2003–2004 and 2005–2006. *J Pediatr Psychol*. 2011.
- 6 Boehmer TK, Lovegreen SL, Haire-Joshu D, Brownson RC. What constitutes an obesogenic environment in rural communities? *Am J Health Promot*. 2006;20(6):411-21.
- 7 Liu JH, Jones SJ, Sun H, Probst JC, Merchant AT, Cavicchia P. Diet, physical activity, and sedentary behaviors as risk factors for childhood obesity: an urban and rural comparison. *Child Obes*. 2012;8(5):440-8.
- 8 Kenney MK, Wang J, Iannotti R. Residency and racial/ethnic differences in weight status and lifestyle behaviors among US youth. *J Rural Health*. 2014;30(1):89-100.
- 9 May M. Living betwixt and between: Conditions of health in borderland colonias. In: Donelson A, editor. *The colonias reader: Economy, housing and public health in US- Mexico border colonias*. Tucson, AZ: The University of Arizona Press; 2010. p. 163-75.
- 10 Mier N, Ory MG, Zhan D, Conkling M, Sharkey JR, Burdine JN. Health-related quality of life among Mexican Americans living in colonias at the Texas-Mexico border. *Soc Sci Med*. 2008;66(8):1760-71.
- 11 United States Department of Agriculture ERS. *Rural economy and population - population and migration 2014*. November 4, 2014. Available from: <http://www.ers.usda.gov/topics/rural-economy-population/population-migration.aspx>.
- 12 Yousefian A, Ziller E, Swartz J, Hartley D. Active living for rural youth: addressing physical inactivity in rural communities. *J Public Health Manag Pract*. 2009;15(3):223-31.
- 13 Hartley D. Rural health disparities, population health, and rural culture. *Am J Public Health*. 2004;94(10):1675-8.
- 14 RAC. *What is Rural?* : Rural Assistance Center; 2015 [cited 2015 April 23]. Available from: <http://www.raconline.org/topics/what-is-rural>.
- 15 Johnson K. *Demographic trends in rural and small town America*. Durham, NH: The Carsey School of Public Policy at the Scholars' Repository, 2006.
- 16 Kirschner A, Berry EH, Glasgow N. The Changing Faces of Rural America. In: Kandel W, Brown D, editors. *Population Change and Rural Society. The Springer Series on Demographic Methods and Population Analysis*. 16: Springer Netherlands; 2006. p. 53-74.
- 17 Moore JB, Brinkley J, Crawford TW, Evenson KR, Brownson RC. Association of the built environment with physical activity and adiposity in rural and urban youth. *Prev Med*. 2013;56(2):145-8.
- 18 Davis AM, Boles RE, James RL, Sullivan DK, Donnelly JE, Swirczynski DL, et al. Health behaviors and weight status among urban and rural children. *Rural and Remote Health*. 2008;8(2):810.
- 19 Moore JB, Beets MW, Morris SF, Kolbe MB. Comparison of Objectively Measured Physical Activity Levels of Rural, Suburban, and Urban Youth. *Am J Prev Med*. 2014;46(3):289-92.
- 20 Sandercock G, Angus C, Barton J. Physical activity levels of children living in different built environments. *Prev Med*. 2010;50(4):193-8.
- 21 Fan JX, Wen M, Kowaleski-Jones L. Rural-urban differences in objective and subjective measures of physical activity: findings from the National Health and Nutrition Examination Survey (NHANES) 2003-2006. *Prev Chronic Dis*. 2014;11:E141.
- 22 Martin SL, Kirkner GJ, Mayo K, Matthews CE, Durstine JL, Hebert JR. Urban, rural, and regional variations in physical activity. *J Rural Health*. 2005;21(3):239-44.
- 23 Casey AA, Elliott M, Glanz K, Haire-Joshu D, Lovegreen SL, Saelens BE, et al. Impact of the food environment and physical activity environment on behaviors and weight status in rural U.S. communities. *Prev Med*. 2008;47(6):600-4.
- 24 Frost SS, Goins RT, Hunter RH, Hooker SP, Bryant LL, Kruger J, et al. Effects of the built environment on physical activity of adults living in rural settings. *Am J Health Promot*. 2010;24(4):267-83.
- 25 Kegler MC, Escoffery C, Alcantara I, Ballard D, Glanz K. A qualitative examination of home and neighborhood environments for obesity prevention in rural adults. *Int J Behav Nutr Phys Act*. 2008;5:65.
- 26 Peterson J, Schmer C, Ward-Smith P. Perceptions of Midwest rural women related to their physical activity and eating behaviors. *J Community Health Nurs*. 2013;30(2):72-82.
- 27 Shores KA, Moore JB, Yin Z. An examination of triple jeopardy in rural youth physical activity participation. *J Rural Health*. 2010;26(4):352-60.
- 28 Seguin R, Connor L, Nelson M, LaCroix A, Eldridge G. Understanding Barriers and Facilitators to Healthy Eating and Active Living in Rural Communities. *Journal of Nutrition and Metabolism*. 2014;2014:8.
- 29 Wilcox S, Castro C, King AC, Housemann R, Brownson RC. Determinants of leisure time physical activity in rural compared with urban older and ethnically diverse women in the United States. *J Epidemiol Community Health*. 2000;54(9):667-72.
- 30 Umstaddt Meyer MR, Sharkey J, Patterson M, Dean W. Understanding contextual barriers, supports, and opportunities for physical activity among Mexican-origin children in Texas border colonias: A descriptive study. *BMC Public Health*. 2013;13(1):14.
- 31 Gangeness JE. Adaptations to achieve physical activity in rural communities. *West J Nurs Res*. 2010;32(3):401-19.
- 32 Chrisman M, Nothwehr F, Yang G, Oleson J. Environmental influences on physical activity in rural Midwestern adults: a qualitative approach. *Health Promotion Practice*. 2015;16(1):142-8.
- 33 Jahns L, McDonald LR, Wadsworth A, Morin C, Liu Y. Barriers and facilitators to being physically active on a rural U.S. northern plains American Indian reservation. *Int J Environ Res Public Health*. 2014;11(11):12053-63.
- 34 Olsen JM. An integrative review of literature on the determinants of physical activity among rural women. *Public Health Nurs*. 2013;30(4):288-311.

- 35 Yousefian A, Hennessy E, Umstattd MR, Economos CD, Hallam JS, Hyatt RR, et al. Development of the Rural Active Living Assessment Tools: measuring rural environments. *Prev Med*. 2010;50 Suppl 1:S86-92.
- 36 Hennessy E, Kraak VI, Hyatt RR, Bloom J, Fenton M, Wagoner C, et al. Active living for rural children: community perspectives using PhotoVOICE. *Am J Prev Med*. 2010;39(6):537-45.
- 37 Sallis JF, Glanz K. *Physical Activity and Food Environments: Solutions to the Obesity Epidemic*. Milbank Q. 2009;87(1):123-54.
- 38 Smith ML, Bazzarre TL, Frisco J, Jackman BA, Cox NJ, Ory MG. Transformation of a rural community for active living. *Fam Community Health*. 2011;34(2):163-72.
- 39 Mishkovsky N, Dalbey, M, Bertaina, S, Read, A, McGalliard, T. *Putting Smart Growth to Work in Rural Communities*. US Environmental Protection Agency and International City/County Management Association, 2010 No. PI-83233801.
- 40 Smart Growth America. *Complete Streets Work In Rural Communities*. March 1, 2015. Available from: www.smartgrowthamerica.org/complete-streets/implementation/factsheets/rural-areas-and-small-towns/.
- 41 National Recreation and Park Association. *Play Deserts: NRPAs*. [April 27 2015]. Available from: www.nrpa.org/Grants-and-Partners/Recreation-and-Health/Play-Deserts/.
- 42 Colorado L. *Guide to Integrating Healthy Eating and Active Living Into Colorado's Rural and Small Town Communities*. Denver, CO: 2012.
- 43 Young DR, Spengler JO, Frost N, Evenson KR, Vincent JM, Whitsel L. Promoting Physical Activity Through the Shared Use of School Recreational Spaces: A Policy Statement from the American Heart Association. *Am J Public Health*. 2014;104(9):1583-8.
- 44 Swanson M, Schoenberg NE, Erwin H, Davis RE. Perspectives on physical activity and exercise among Appalachian youth. *J Phys Act Health*. 2013;10(1):42-7.
- 45 Dunton GF, Kaplan J, Wolch J, Jerrett M, Reynolds KD. Physical environmental correlates of childhood obesity: a systematic review. *Obes Rev*. 2009;10(4):393-402.
- 46 Dalton MA, Longacre MR, Drake KM, Gibson L, Adachi-Mejia AM, Swain K, et al. Built environment predictors of active travel to school among rural adolescents. *Am J Prev Med*. 2011;40(3):312-9.
- 47 Safe Routes to School National Partnership. Rural Communities: Making Safe Routes Work. Available from: http://saferoutespartnership.org/sites/default/files/pdf/Lib_of_Res/SR2S_Rural_making%20SR%20work_20150331.pdf.
- 48 Walia S, Leipert B. Perceived facilitators and barriers to physical activity for rural youth: an exploratory study using photovoice. *Rural Remote Health*. 2012;12:1842.
- 49 Kegler MC, Swan DW, Alcantara I, Wrensford L, Glanz K. Environmental influences on physical activity in rural adults: the relative contributions of home, church and work settings. *J Phys Act Health*. 2012;9(7):996-1003.
- 50 Wilcox S, Oberrecht L, Bopp M, Kammermann SK, McElmurray CT. A qualitative study of exercise in older African American and white women in rural South Carolina: perceptions, barriers, and motivations. *J Women Aging*. 2005;17(1-2):37-53.
- 51 Adachi-Mejia AM, Drake KM, MacKenzie TA, Titus-Ernstoff L, Longacre MR, Hendricks KM, et al. Perceived intrinsic barriers to physical activity among rural mothers. *J Womens Health (Larchmt)*. 2010;19(12):2197-202.
- 52 Shores KA, West ST, Theriault DS, Davison EA. Extra-individual correlates of physical activity attainment in rural older adults. *J Rural Health*. 2009;25(2):211-8.
- 53 Aytur SA, Satinsky SB, Evenson KR, Rodriguez DA. Pedestrian and bicycle planning in rural communities: tools for active living. *Fam Community Health*. 2011;34(2):173-81.
- 54 Barnidge EK, Radvanyi C, Duggan K, Motton F, Wiggs I, Baker EA, et al. Understanding and addressing barriers to implementation of environmental and policy interventions to support physical activity and healthy eating in rural communities. *J Rural Health*. 2013;29(1):97-105.
- 55 Edwards MB, Theriault DS, Shores KA, Melton KM. Promoting youth physical activity in rural southern communities: practitioner perceptions of environmental opportunities and barriers. *J Rural Health*. 2014;30(4):379-387.
- 56 Moreland-Russell S, Eyley A, Barbero C, Hipp JA, Walsh H. Diffusion of Complete Streets Policies Across US Communities. *J Public Health Manag Pract*. 2013;19:S89-S96.
- 57 Edwards MB, Kanters MA, Bocarro JN. Opportunities for extracurricular physical activity in North Carolina middle schools. *J Phys Act Health*. 2011;8(5):597-605.
- 58 Robinson JC, Carson TL, Johnson ER, Hardy CM, Shikany JM, Green E, et al. Assessing environmental support for better health: Active living opportunity audits in rural communities in the southern United States. *Prev Med*. 2014;66:28-33.
- 59 Ding D, Sallis JF, Kerr J, Lee S, Rosenberg DE. Neighborhood environment and physical activity among youth: a review. *Am J Prev Med*. 2011;41(4):442-55.
- 60 Kasehagen L, Busacker A, Kane D, Rohan A. Associations between neighborhood characteristics and physical activity among youth within rural-urban commuting areas in the US. *Matern Child Health J*. 2012;16 Suppl 2:258-67.
- 61 Nasar JL. Assessing Perceptions of Environments for Active Living. *Am J Prev Med*. 2008;34(4):357-63.
- 62 Umstattd MR, Baller SL, Hennessy E, Hartley D, Economos CD, Hyatt RR, et al. Development of the Rural Active Living Perceived Environmental Support Scale (RALPESS). *J Phys Act Health*. 2012;9(5):724-30.
- 63 Scanlin K, Haardoerfer R, Kegler MC, Glanz K. Development of a pedestrian audit tool to assess rural neighborhood walkability. *J Phys Act Health*. 2014;11(6):1085-96.
- 64 Fisher BD, Richardson S, Hosler AS. Reliability test of an established pedestrian environment audit in rural settings. *Am J Health Promot*. 2010;25(2):134-7.
- 65 Evenson KR, Sotres-Alvarez D, Herring AH, Messer L, Laraia BA, Rodriguez DA. Assessing urban and rural neighborhood characteristics using audit and GIS data: derivation and reliability of constructs. *Int J Behav Nutr Phys Act*. 2009;6:44.