

Supplemental Table 2. Objective Environmental Research for Physical Activity (PA), Healthy Eating (HE), and Breastfeeding (BF) in Rural Settings (n=99).

First Author, Year	Citation in AMA format	Source		Behavior			Results
		Data Collection Measure/Method	Setting(s)	BF	H E	PA	
Adachi-Mejia et al, 2013	Adachi-Mejia AM, Longacre MR, Skatrud-Mickelson M, et al. Variation in access to sugar-sweetened beverages in vending machines across rural, town and urban high schools. <i>Public Health</i> . 2013;127(5):485-491.	Trained coders recorded beverage machine content (e.g., sugar sweetened, diet beverages, plain, flavored water, juices, milk) and machine-front advertising that included brand names.	Schools		X		Town schools were significantly more likely to offer sugar sweetened beverages than urban schools. Rural schools were also more likely to offer sugar sweetened beverages than urban schools, but the difference was not significant. Advertisements for sugar sweetened beverages were most prevalent in town schools.
Ahern et al, 2011	Ahern M, Brown C, Dukas S. A national study of the association between food environments and county-level health outcomes. <i>J Rural Health</i> . 2011;27(4):367-379.	Secondary data sources merged at the county level, which included food environment measures using the Food Environment Atlas; the 2007 Agricultural Census provided direct farm sales.	Food retail		X		Compared with metro counties (n=1,089), non-metro (n=2,039) had fewer fast-food restaurants (0.57% vs. 0.64%), more full-service restaurants (0.87% vs 0.68%), grocery stores (0.34% vs 0.21%), and convenience stores (0.72% vs 0.5%), greater value of direct farm sales per capita (\$8.20 vs \$5.46), and more households with no cars farther than 1 mile from a grocery store (4.4% vs 3.1%).
Ahmed & Byker Shanks, 2017	Ahmed S, Byker Shanks C. Quality of vegetables based on total phenolic concentration is lower in more rural consumer food environments in a rural American state. <i>Int J Environ Res Public Health</i> . 2017;14(8).	Total phenolic (TP) scores to assess phytochemicals in fruits and vegetables; the Nutrition Environment Measurement Survey for Stores (NEMS-S) that included average availability, price and quality as well as total scores.	Food retail		X		Fruit and vegetable (FV) samples stores were tested regarding quality or Total phenolic (TP) scores. Significant differences were found in the means of the FV TP scores (p< 0.0001) and vegetable TP scores (p< 0.0001) on the basis of rurality, but not for fruit TP scores by rurality (p=0.2158). Specifically, FV TP scores and vegetable TP scores were highest for the least rural stores and lowest for the most rural stores. Average NEMS-S scores for sampled stores (n=12) was 24.7 (SD=7.2; out of 54).
Amerson et al, 2014	Amerson N, Nelson M, Radcliffe A, Moody C, Williams L, Miles C. Adoption of sodium reduction strategies in small and rural	Healthy Hospitals Environmental Scan which consists of approximately 200 questions and 2 areas for	Hospitals		X		Scan results showed an increase in the availability of sodium information and sodium messages in the hospitals. The number of hospitals that provide sodium

	hospitals, Illinois, 2012. <i>Prev Chronic Dis.</i> 2014; 11:E42.	assessment: the cafeteria and the vending machines. Additional questions were added to the scan to collect more sodium-specific data.			information in the cafeteria, in printed brochures, and vending machines increased. Easy access to discretionary salt use (salt shakers or packets on tables) remained high in funded hospitals, but there was little to no change in pricing strategies to promote healthful food items.
Anderson Steeves et al, 2015	Steeves EA, Penniston E, Rowan M, Steeves J, Gittelsohn J. A rural small food store pilot intervention creates trends toward improved healthy food availability. <i>J Hunger Environ Nutr.</i> 2015;10(2):259-270.	Store Food Availability Checklist, which assessed the availability of 12 healthier promoted foods.	Food retail	X	This study increased stocking of fresh and canned vegetables and canned fruit from 8% to 30% but saw an unexpected decrease in stocking of fresh fruit. The observational analysis of the stocking data showed that all intervention stores (n=4) had most, but not all, of the promoted food items available, compared to relatively low availability of promoted items at comparison stores (n=4)
Askelson et al., 2019	Askelson NM, Brady P, Ryan G, Meier C, Ortiz C, Scheidel C, Delger P. Actively Involving Middle School Students in the Implementation of a Pilot of a Behavioral Economics-Based Lunchroom Intervention in Rural Schools. <i>Health Promot Pract.</i> 2019 Sep;20(5):675-683.	Food production records reporting vegetable, fruit, and milk production for 1 week in the fall and 1 week in the spring. The number of servings for each vegetable, fruit, and milk initially prepared and the number of servings left over were calculated. The food service director completed production records approximately 4 months apart.	Schools	X	An intervention was piloted in six middle schools featuring behavioral economics-based changes to the lunchroom, communication training, and communicate cues for food service staff. Two schools increased servings of fruit and three schools increased servings of total servings of vegetables and total servings of milk. One school increased servings of dark green vegetables, two schools increased servings of starchy, and other vegetables, and four schools increased servings of beans and peas and red/orange vegetables. Two schools increased servings on 1% white milk, two schools increased servings of skim white milk, and four schools increased servings of skim chocolate milk..
Atkinson et al, 2010	Atkinson NL, Desmond SM, Saperstein SL, Billing AS, Gold RS, Tourmas-Hardt A. Assets, challenges, and the potential of technology for nutrition education in rural communities. <i>J Nutr Educ Behav.</i> 2010;42(6):410-416.	Windshield tours by Cooperative Extension, including a checklist inventory of community features.	Food retail; schools; streets	X X	Residents of one rural community had less access to lower-cost food outlets compared to fast-food restaurants and convenience stores. For PA, lack of sidewalks and inadequate school recreation programming was related with less PA.

Baker et al, 2017	Baker EA, Elliott M, Barnidge E, et al. Implementing and evaluating environmental and policy interventions for promoting physical activity in rural schools. <i>J Sch Health</i> . 2017;87(7):538-545.	System for Observing Play and Leisure Activity in Youth (SOPLAY) observations to assess facilitators, barriers and the effect of the dissemination of environmental and policy changes on students' behaviors.	Schools	X	Participants noted the importance of providing training, assistance with implementation planning, and funding, as opposed to simply providing information about effective practices. Environmental (e.g., creation of tracks) and policy (e.g., brain breaks) interventions increased PA among rural youth.
Bardenhagen et al, 2017	Bardenhagen CJ, Pinard CA, Pirog R, Yaroch AL. Characterizing Rural Food Access in Remote Areas. <i>J Community Health</i> . 2017 Oct;42(5):1008-1019.	Items from the Bridging the Gap Community Obesity Measures Project (BTG-COMP) Food Store Observation Form and the Food Retail Outlet Survey Tool (FROST) were combined and modified to create a rural food environment scan tool	Food retail	X	Of the 20 stores that were assessed, there were small grocers/convenience stores without gas (n = 7), small or mid-sized grocers with gas (n = 6), mid-sized independent grocers (n = 5), and limited assortment/food mart/gas stations (n = 2). Out-shopping, seasonality, and economic challenges were found to affect healthy food availability. Mid-sized independent stores were generally found to have a larger selection of healthy foods, but smaller rural groceries also have potential to provide fresh produce and increase food access.
Barnes et al, 2016	Barnes TL, Freedman DA, Bell BA, Colabianchi N, Liese AD. Geographic measures of retail food outlets and perceived availability of healthy foods in neighbourhoods. <i>Public Health Nutr</i> . 2016 Jun;19(8):1368-74	Participant addresses were linked with an existing, previously validated geospatial database on food retail outlets (including Dun and Bradstreet and InfoUSA data) and the presence of food outlets within the buffer, defined as yes or no. Distance to the nearest retail food outlet was calculated using the shortest street distance based on StreetMap Premium for ArcGIS (ESRI; 2008). The outlet types included supermarkets, supercentres, warehouse clubs (of note, there is only one warehouse club within the study region), convenience stores, drug and pharmacy stores, dollar and	Food retail	X	The presence of a supermarket within an 8.05 km (5-mile) buffer area was significantly associated with perceived availability of healthy foods ( $\beta=1.09$ , $P=0.025$ ) when controlling for all other food outlet types. However, no other derived geographic presence measures were significant predictors of perceived availability of healthy foods. Distances to the nearest supermarket ( $\beta=-0.16$ , $P=0.003$ ), dollar and variety store ( $\beta=-0.15$ , $P=0.005$ ) and fast-food restaurant ( $\beta=0.11$ , $P=0.015$ ) were all significantly associated with perceptions of healthy food availability.

		variety stores, and franchised fast-food restaurants.		
Bevans et al, 2010	Bevans KB, Fitzpatrick LA, Sanchez BM, Riley AW, Forrest C. Physical education resources, class management, and student physical activity levels: A structure-process-outcome approach to evaluating physical education effectiveness. <i>J Sch Health</i> . 2010;80(12):573-580.	System for Observing Fitness Instruction Time (SOFIT) to assess lesson length, student activity levels, and the percent of session time devoted to class management.	Schools	X In rural schools (n=34), access to adequate exercise equipment/facilities predicted increased moderate vigorous PA in physical education time by 1.4% and decreased classroom management time by 2%.
Blair et al, 2020	Blair A, MacGregor E, Lee N. Childhood obesity and breastfeeding rates in Pennsylvania Counties-spatial analysis of the Lactation Support Landscape. <i>Front Public Health</i> . 2020;8:123.	The Academy of Lactation Policy and Practice (ALPP) records. International Lactation Consultant Association (ILCA) records to assess childhood obesity prevalence, breastfeeding rates in different geographic locations.	Healthcare	X Highest concentrations of Lactation Support Providers (LSPs) are in the southeast state district and there are more Certified Lactation Counselors (CLCs) throughout all counties compared to International Board-Certified Lactation Consultants (IBCLCs) in Pennsylvania. In counties with more CLCs (n=67), breastfeeding rates are higher (p < 0.05). In counties with more professional LSPs (n=4), BF rates are highest.
Bontrager Yoder et al, 2014	Bontrager Yoder AB, Liebhart JL, McCarty DJ, et al. Farm to elementary school programming increases access to fruits and vegetables and increases their consumption among those with low intake. <i>J Nutr Educ Behav</i> . 2014;46(5):341-349.	An online food frequency questionnaire assessed overall dietary intake, including portion sizes and pictures. A lunch tray photo observation, which involved digital photography during school lunch before and after eating lunches. Photo observations assessed the number of fruit and vegetables, amount (cups) and consumption value of fruit and vegetables, as 100%, 75%, 50%, 25%, or 0%.	Schools; local food producers	X Wisconsin Farm to School programming ranged from Harvest of the Month alone to comprehensive, including school garden, locally sourced produce in school meals, and classroom lessons. Wisconsin Farm to School programs resulted in significant increases in attitudes (3%), knowledge (4%), exposure (3%) and willingness (2%) scores related to fruit and vegetable access and consumption. No effect on overall dietary patterns was observed, although fruit and vegetable consumption increased among those with the lowest intakes.
Bower et al, 2014	Bower KM, Thorpe RJ, Jr., Rohde C, Gaskin DJ. The intersection of neighborhood racial segregation, poverty, and urbanicity and its impact on food store availability in	Secondary data from Census Bureau and InfoUSA to provide Standard Industrial Classification (SIC) to map out food stores on the census tract level.	Food retail	X As neighborhood poverty increased, supermarket availability decreased and grocery and convenience stores increased. At equal levels of poverty, predominantly Black tracts had the fewest supermarkets and predominantly

	the United States. <i>Prev Med.</i> 2014;58:33-39.			White tracts had the most. Predominantly Hispanic tracts had the most grocery stores at all levels of poverty. In rural tracts, neither racial composition nor poverty level predicted supermarket availability.
Bungum et al, 2009	Bungum TJ, Lounsbery M, Moonie S, Gast J. Prevalence and correlates of walking and biking to school among adolescents. <i>J Community Health.</i> 2009;34(2):129-134.	Data on the street connectedness was assessed, defined as the total number of intersections within 4,000 feet of the school; survey consisted of 30 items included questions on transportation to school, amount of PA, and dietary habits.	Schools; streets	X Only 124 adolescents (5%) reported using Active Transport to Schools (ATS). Boys were more likely to bike or walk compared to girls ( $P<0.05$ ). Street connectedness was a significant predictor of the use of active transport to school. Regression model predicting the use of active transport to school, (n = 124). Connectedness Odds Ratio: 2.08, CI: 1.19 - 3.65, P-value: 0.011. Those who attended the most connected school were 2.08 (CI = 1.19–3.60) times more likely to use Active Transport to School than were those at the other schools. PA barriers or benefits were not predictive of using ATS among boys and girls.
Bustillos et al, 2009	Bustillos B, Sharkey JR, Anding J, McIntosh A. Availability of more healthful food alternatives in traditional, convenience, and nontraditional types of food stores in two rural Texas counties. <i>J Am Diet Assoc.</i> 2009;109(5):883-889.	An observational survey was developed and used to document availability and variety of fruit/vegetables (fresh, canned, frozen), meats (meat, poultry, fish, eggs), dairy (milk, yogurt, cheese), and grains (whole grains, refined grains) in all traditional food stores, convenience stores, and nontraditional food stores (dollar stores, mass merchandisers) in two rural Texas counties.	Food retail	X In two rural counties, more healthful canned fruits and fruit juices were available across all store formats. Supermarkets offered a greater variety of fresh fruits ( $p=0.01$ ) than grocery stores. Supermarkets offered greater variety in 100% fruit juices than grocery stores ( $p=0.001$ ); the variety was greater at grocery stores compared with convenience stores ( $p=0.05$ ) and at dollar stores compared with convenience stores ( $p=0.02$ ). Supermarkets offered a greater variety of fresh vegetables ( $p=0.001$ ) than grocery stores. Traditional and nontraditional food stores that carried canned vegetables carried a large variety.
Byker Shanks et al, 2015	Byker Shanks C, Ahmed S, Smith T, et al. Availability, price, and quality of fruits and vegetables in 12 rural Montana counties, 2014. <i>Prev Chronic Dis.</i> 2015;12:E128.	Nutrition Environment Measures Survey in Stores (NEMS-S) to score the availability, price, and quality of fruit and vegetables.	Food retail	X Results showed significant differences in NEMS-S scores for quality of fruits and vegetables; of 6 possible points, the mean quality score was 4.5; of rural stores, the least rural stores had the highest mean quality scores (6.0). Availability and

				price of fruits and vegetables did not differ by rurality. Fruit/vegetable quality was significantly lower in more rural locations.
Carlton et al, 2017	Carlton TA, Kanters MA, Bocarro JN, Floyd MF, Edwards MB, Suau LJ. Shared use agreements and leisure time physical activity in North Carolina public schools. <i>Prev Med.</i> 2017 Feb;95S:S10-S16.	The System for Observing Play and Recreation in Communities (SOPARC), a widely accepted approach for assessing PA in community settings. The amount of structured physical activity programs at schools with SUAs was assessed using the Structured Physical Activity Survey (SPAS) instrument	Schools	X The majority of facilities observed were empty (87.7%) with no PA observed. Outdoor tracks had the lowest proportion of empty observations (75%) while indoor gyms had the highest (92%). Multi-purpose, baseball, and softball fields accounted for over half of the empty observations. Baseball/softball fields were the most used but contained low TMETs on average. The most used facilities were baseball and softball fields followed by multipurpose fields, indoor gyms, tracks, and tennis courts being the least used. Sedentary participants were most frequently found in baseball and softball fields. Males were observed using facilities more frequently than females. The age distribution was almost even (51% child; 49% adult).
Comstock et al, 2016	Comstock C, Kattelman K, Zastrow M, McCormack L, Lindshield E, Li Y, Muturi N, Adhikari K, Kidd T. Assessing the Environment for Support of Youth Physical Activity in Rural Communities. <i>J Nutr Educ Behav.</i> 2016 Apr;48(4):234-41.e1.	The PA environment was assessed using the Active Neighborhood Checklist (ANC) and the Physical Activity Resource Assessment (PARA). Youth behavior and perceptions related to PA and the local environment were assessed using 5 questions from previously validated tools.	Streets	X Total ANC scores ranged from 16.6 (SD, 7.1) to 23.0 (SD, 2.0). There were no differences among communities in total ANC scores or sub scores of land use, public transportation, quality of the environment, or places to walk or bicycle ( $P \leq .05$ ). There was a difference in average street characteristics among the 4 communities. Perception was weakly correlated with total ANC (multivariate coefficient, 0.016; $P = .026$ ; $n = 308$ ) but not total PARA.
Creel et al, 2008	Creel JS, Sharkey JR, McIntosh A, Anding J, Huber JC, Jr. Availability of healthier options in traditional and nontraditional rural fast-food outlets. <i>BMC Public Health.</i> 2008;8:395.	A two-part observational survey instrument was developed. The first part recorded site information, such as store type, store hours, store exterior (parking lot and building), condition of the parking lot, ads or	Food retail	X Rural supermarket/grocery stores ( $n=12$ ) provided greater variety by 90.9% of regular entrées and side dishes by 61% in all locations than traditional fast-food outlets ( $n=84$ ) or convenience stores ( $n=109$ ). Convenience stores offered less variety in healthier breakfast and lunch/dinner entrées than traditional fast-

		<p>promotions identifying fast food, ads or promotions for healthy foods, store interior, store size, and number of registers. The second part of the survey instrument included an assessment of menu items including availability of healthier options, identification of nutritional information, and preparation methods. Using data from the Brazos Valley Food Environment Project, all traditional fast food outlets, supermarkets/grocery stores, and convenience stores were assessed for availability of fast-food items. Using the North American Industry Classification System as a guide, we defined the outlets based on their primary business</p>				<p>food outlets or supermarket/grocery stores. Compared with fast food outlets, convenience stores and supermarket/grocery stores were more likely to have a greater variety of regular entrées and side dishes. Traditional fast-food outlets offered a greater variety of healthier breakfast entrées, healthier lunch/dinner entrées, and healthier lunch/dinner side dishes.</p>
Dalton et al, 2011	<p>Dalton MA, Longacre MR, Drake KM, et al. Built environment predictors of active travel to school among rural adolescents. <i>Am J Prev Med.</i> 2011;40(3):312-319.</p>	<p>Onsite observation by trained coders that used the Irvine Minnesota Inventory for measuring built environment and Geographic Information Systems (GIS) to record food stores within schools.</p>	<p>Schools; food retail; sidewalks; streets.</p>	X	X	<p>Among active travelers residing in rural areas (n=388), active travel to school frequency was positively associated with higher residential and intersection densities, a greater number of food outlets, the presence of sidewalks, curbs, on-street parking, small setbacks, continuous and taller buildings.</p>
D'Angelo, 2017	<p>D'Angelo H, Ammerman A, Gordon-Larsen P, Linnan L, Lytle L, Ribisl KM. Small food store retailers' willingness to implement Healthy Store Strategies in rural North Carolina. <i>J Community Health.</i> 2017;42(1):109-115.</p>	<p>Observation to assess the stocking and promotion of healthy food, beverages and tobacco in stores</p>	<p>Food retail</p>	X		<p>All stores sold low-calorie beverages, sugar-sweetened beverages, candy and cigarettes. Fresh fruits were sold at 30.2 % of stores; only 9.4 % sold fresh vegetables. Retailers reported being most willing to stock skim/low-fat milk, display healthy snacks near the register, and stock whole wheat bread. About 50 % were willing to stock at least three fresh fruits and three fresh vegetables, however only 2 % of stores currently stocked these foods.</p>

Davis et al, 2014	Davis SM, Cruz TH, Kozoll RL. Health Impact Assessment, Physical Activity and Federal Lands Trail Policy. <i>Health Behav Policy Rev.</i> 2014 Jan;1(1):82-95.	A physical assessment of the potential trail access locations was conducted. The Team members traced the routes under consideration and examined the locations where the routes crossed roadways. The assessment included a preliminary scan of each of 7 roadway crossing sites for safety, feasibility, degree of difficulty, and distance from Cuba and each other. Before final recommendations can be made, a more extensive safety audit of each potential trail-head will be required.	Trails	X	Preliminary recommendations include multiple, well-spaced trailheads, wider trail tread than customary, and minimal grades (<5%). Public input prioritized locations with safe and convenient access, a level and sufficiently large area for parking, signage, and a variety of hiking experiences, both with regard to scenic beauty and degree of difficulty.
Davis et al, 2017	Davis MM, Spurlock M, Ramsey K, Smith J, Beamer BA, Aromaa S, McGinnis PB. Milk Options Observation (MOO): A Mixed-Methods Study of Chocolate Milk Removal on Beverage Consumption and Student/Staff Behaviors in a Rural Elementary School. <i>J Sch Nurs.</i> 2017 Aug;33(4):285-298.	Study team members applied coded numerical identifiers on all student beverage containers (including those brought from home and those available through the school) at the start of lunch and collected containers at the end of lunch. This enabled tracking beverage consumption for individual students. Beverage consumption was measured using standard beakers by two research team members to ensure accuracy.	Schools	X	Authors recorded a total of 1,874 school-provided beverage choices from 360 unique students over the 6 days of observation. Prior to removal, chocolate milk was the most common beverage selected (57.4%), while bottled water was most common (56.9%) after removal. White milk selection increased from 5.4% preremoval to 43.1% post-removal.
Davis et al, 2019	Davis J, Jossefides M, Lane T, Pijawka D, Phelps M, Ritchey J. A spatial evaluation of healthy food access: Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) participants. <i>J Public Health Manag Pract.</i> 2019;25:S91-S96.	Arizona Department of Transportation (ADOT) road data, Open Street map data, and U.S. Census 2010 data were used to determine travel distances, travel times, and urban and nonurban status. Open Street map data were used as a supplement to ADOT data, because these possessed better documentation of roads in	Food assistance programs; food retail	X	Access to nutritional information, health care, and healthy foods for WIC participants increased from 66% to 74% in non-urban areas, 2014-2016. The biggest drops in travel distance and travel time observed were with new store additions from 2014 to 2016 among non-urban WIC participants who were more than 10 miles from a store; average travel time was reduced by 16 minutes and travel distance was decreased by about 8 miles.

		rural areas and on tribal lands. Only road features were included in the network data set, and only roads that had assigned speed limits were included within the attribute data.		
Deller et al, 2015	Deller S, Canto A, Brown L. Rural poverty, health and food access. <i>Regional Science Policy &amp; Practice</i> . 2015;7(2):61-74.	The food access index, using the U.S. Department of Agriculture Food Environment Atlas to measure access to food stores. Healthy food access measures were combined and include grocery stores, specialty food stores, supercenters, and farmers' markets all on a per 1,000 population basis.	Food retail	X
Demment et al, 2015	Demment M, Wells N, Olson C. Rural middle school nutrition and physical activity environments and the change in body mass index during adolescence. <i>J Sch Health</i> . 2015 Feb;85(2):100-8.	The N&PA environment assessment tool distinguished school environments that promoted HE and physical activity from environments that did not. The finalized tool was comprised of 3 surveys, one each for the principal, food service director, and PE teacher, and one researcher observation checklist. Each question or observation was coded to capture if the environmental characteristic, policy, or action was health promoting. Either 1 or 0 was assigned to each dichotomous variable (yes or no).	Schools	X X
Dunn et al, 2011	Dunn RA, Sharkey JR, Lotade-Manje J, Bouhlal Y, Nayga RM, Jr. Socio-economic status, racial composition and the affordability of fresh fruits and vegetables in	Ground-truthed data from the Brazos Valley Food Environment Project were used to identify all food stores in the rural region and the availability and lowest	Food retail	X
				The result suggests that the poverty and poor health relationship and that improved access to healthier food is associated with better public health outcomes in rural counties. There is mixed evidence that the poverty and poor health relationship is stronger in rural areas with limited food access. Higher access to foods within a rural setting tends to be associated with poorer health.
				Authors found considerable heterogeneity in environments within and between schools. Among students with low-income trajectories, reductions in BMI z-scores were associated with school environments that promote better physical education (PE) and general (non-PE, non-sport) physical activity. Schools with better sports environments were associated with reductions in BMI for some students, but not lower-income students.
				Stores in higher incomes neighborhoods charged more for fresh fruits and vegetables. This could be attributed to rural stores facing less price competition. Stores located in neighborhoods with higher proportions of African American

	neighborhoods of a large rural region in Texas. <i>Nutr J.</i> 2011;10:6.	price of fresh whole fruit and vegetables in the food stores.			residents tended to charge a higher price for fresh produce items. This may be attributed to a greater proportion of African Americans residing in neighborhoods with small grocery and convenience stores.
Dunn et al, 2012	Dunn RA, Sharkey JR, Horel S. The effect of fast-food availability on fast-food consumption and obesity among rural residents: an analysis by race/ethnicity. <i>Econ Hum Biol.</i> 2012 Jan;10(1):1-13.	Information on the availability of fast-food was taken from the Brazos Valley Food Environment Project (BVFEP). The BVFEP used ground-truthing to identify all retail stores and service places selling food items in the Brazos Valley region, geocode their location, record a detailed inventory of food items that were sold and record the prices charged for these items	Food retail	X	Authors found that non-whites tended to exhibit higher obesity rates, greater access to fast-food establishments and higher consumption of fast-food meals compared to their white counterparts. In addition, authors found that whites and non-whites responded differently to the availability of fast-food in rural environments. Greater availability was not associated with either greater consumption of fast-food meals or a higher obesity risk among the sample of whites. In contrast, greater availability of fast-food was positively associated with both the number of meals consumed for non-white rural residents and their obesity.
Escaron et al, 2016	Escaron AL, Martinez-Donate AP, Riggall AJ, Meinen A, Hall B, Nieto FJ, Nitzke S. Developing and Implementing "Waupaca Eating Smart": A Restaurant and Supermarket Intervention to Promote Healthy Eating Through Changes in the Food Environment. <i>Health Promot Pract.</i> 2016 Mar;17(2):265-77.	The team tracked the strategies outlets agreed to implement and baseline availability of healthy meals (restaurants only). Performed direct observation of implementation of restaurant and store strategies prior to the beginning of the intervention, 4 to 6 months into the intervention, and 2 months after the end of the intervention. At each of these time points, coalition staff visited each outlet unannounced and, using a checklist, recorded which Waupaca Eating Smart materials and other components of the program were present.	Food retail	X	Prior to this intervention, only one of seven restaurants had three or more meals that met WES nutrition criteria. By the end of the program, 38 meals were labeled and promoted to restaurant customers, and the team had staffed four side salad taste tests for supermarket customers. Four and 10 months after intervention launch, the majority of the program's strategies were observed in participating outlets, suggesting that these program's strategies are feasible and can be sustained.

Fan et al, 2015	Fan JX, Wen M, Kowaleski-Jones L. Sociodemographic and environmental correlates of active commuting in rural America. <i>J Rural Health</i> . 2015;31(2):176-185.	The 2000 Decennial Census collected by the Census Bureau and supplemented with tract/county level data from National Land Cover Database (2001), Environmental System Research Institute (ESRI) and StreetMap USA (2000), and Environmental Protection Agency (EPA, 2006).	Parks, streets, sidewalks	X	Better economic well-being was negatively associated with active commuting but percentage of college-educated was a positive correlate. Population density was positively associated with active commuting but greenness and proximity to parks were negative correlates. However, significant differences existed for different AC modes, and between small rural and town-micropolitan rural tracts.
Fan et al, 2017	Fan JX, Wen M, Wan N. Built Environment and Active Commuting: Rural-Urban Differences in the U.S. <i>SSM Popul Health</i> . 2017 Dec;3:435-441.	3D's of density, diversity, and design including population density, street connectivity, housing age, greenness, proximity to parks, and air quality.	Parks; streets; sidewalks	X	Active commuting (AC) rates were 3.44% rural and 2.77% urban (p<0.01) for walking to work, 0.40% rural and 0.58% urban (p<0.01) for biking to work, and 0.59% rural and 5.86% urban (p<0.01) for public transportation to work. Some environmental variables had similar relationships with AC in rural and urban tracts, such as a negative association between tract greenness and prevalence of walking to work. Others had opposite correlational directions for rural vs. urban, such as street connectivity for walking to work and population density for both walking to work and public transportation to work.
Findholt et al, 2011	Findholt NE, Michael YL, Jerofke LJ, Brogoitti VW. Environmental influences on children's physical activity and eating habits in a rural Oregon County. <i>Am J Health Promot</i> . 2011;26(2):e74-85.	Structured observations were completed using the PA Resource Assessment, System for Observing Play and Leisure Activity, Community Food Security Assessment Toolkit, and School Food and Beverage Marketing Assessment Tool. In-depth interviews, focus groups, Photovoice were also used.	Food retail, recreational facilities, schools, street, natural environment	X X	Limited recreational resources, street-related hazards, fear of strangers, inadequate physical education, and denial of recess hindered PA, whereas popularity of youth sports and proximity to natural areas promoted it. Limited availability and high cost of healthy food, busy lifestyle, convenience stores near schools, few healthy meal choices at school, snacks from home permitted at school, candy as incentives, and teachers' modeling Unhealthy eating habits hindered HE. Agricultural setting and popularity of gardening promoted HE.
Flamm, 2011	Flamm L. Barriers to EBT use at farmers' markets: Lessons in empowerment evaluation from rural	A comparison between The Oxford Farmers Market Uptown prices and	Food assistance	X	The Oxford Farmers Market Uptown (OFMU) offers "market baskets" of the weekly recommendations for potatoes,

	Ohio. <i>J Hunger Environ Nutr.</i> 2011;6(1):54-63.	supermarket prices using data provided by vendors.	programs; food retail		other vegetables, whole fruit, and egg categories for a family size set by the USDA's Thrifty Food Plan. Market basket is \$45.60 at OMFU compared to \$55.61 on average from supermarkets. This comparison reveals that purchasing fresh goods from OMFU would be more affordable, but it does not prevent shoppers of using Electronic beneficial transfer (EBT) at OFMU.
Fretts et al, 2018	Fretts AM, Huber C, Best LG, et al. Availability and cost of healthy foods in a large American Indian Community in the North-Central United States. <i>Prev Chronic Dis.</i> 2018;15:E03.	Nutrition Environment Measures Survey in Stores (NEMS-S) to evaluate food items in food stores	Food retail	X	The cost of the USDA Thrifty Food Plan (TFP) was 15% lower at the discount supermarket than at grocery stores (\$152.91 vs. \$179.52, respectively). The cost of foods that made up the TFP market basket varied across food groups. Convenience and discount/dollar stores did not carry enough food items to fulfill the TFP; 94% of foods were unavailable at convenience stores and 64% were unavailable at discount/dollar stores.
Gantner et al, 2011	Gantner LA, Olson CM, Frongillo EA, Wells NM. Prevalence of nontraditional food stores and distance to healthy foods in a rural food environment. <i>J Hunger Environ Nutr.</i> 2011;6(3):279-293.	Geographic Information System to map women's home addresses using the ArcGIS software; Survey based on the Nutrition Environment Measures Survey in Stores (NEMS-S) to assess the availability and number of varieties of food items categories.	Food retail	X	Many nontraditional food stores constituted the rural food environment, and these stores were closer on average to households than traditional food stores. Fresh produce was available in only 43% of stores (mainly supermarkets and grocery stores and about one third of convenience stores). Less healthful foods, like soda and chips, were sold in nearly all stores. On average residents lived about 68% further away from fresh produce, like apples and tomatoes, than processed foods like soda and chips. Though 91% of households had food store within 5 miles of their home, 36% of residents had to travel 10 or more miles to reach a supermarket.
Gibson, 2011	Gibson DM. The neighborhood food environment and adult weight status: Estimates from longitudinal data. <i>Am J Public Health.</i> 2011;101(1):71-78.	The U.S. Census Bureau's ZIP Code Business Patterns Data to identify neighborhood density per square mile of supermarkets, small grocery stores,	Food retail	X	The neighborhood density of small grocery stores was not significantly related to current weight status for residents of rural areas. Likelihood of shopping at a small grocery store does not differ between residents of rural

		convenience and specialty food stores, limited-service restaurants, and full-service restaurants.			neighborhoods with a higher density of small grocery stores versus those with a lower density. For individuals who moved from a rural area to an urban area over a 2-year period, changes in neighborhood supermarket density, small grocery store density, and full-service restaurant density was significantly related to the change in body mass index over that period.
Graves et al, 2008	Graves A, Haughton B, Jahns L, Fitzhugh E, Jones SJ. Biscuits, sausage, gravy, milk, and orange juice: school breakfast environment in 4 rural Appalachian schools. <i>J Sch Health</i> . 2008;78(4):197-202.	U.S. Department of Agriculture Traditional Planning System menu documentation to measure schools' food environment.	Food assistance program; schools.	X	Rural schools in this study exceeded the School Breakfast Program guidelines for calories from fat and saturated fat (43% and 15%, respectively) when examined on a daily basis. The school breakfast environment at the 4 rural Appalachian schools provided on average 540 calories, 26 g of fat, 9 g of saturated fat, and 2 g of fiber per person. Almost half of the students in the participating schools ate school breakfast.
Grubestic & Durbin, 2017	Grubestic TH, Durbin KM. Breastfeeding support: A geographic perspective on access and equity. <i>J Hum Lact</i> . 2017;33(4):770-780.	List of all Baby-Friendly hospitals and lactation practitioners from the International Lactation Consultant Association, locations of all active La Leche League International (LLL) and breastfeeding USA (BUSA)	Healthcare; hospitals	X	Rural areas in Ohio were found to have reduced access to breastfeeding support services in comparison to urban areas, e.g., Baby-Friendly facilities, and the International Board Certified Lactation Consultants (IBCLCs).
Gustafson et al, 2012	Gustafson AA, Lewis S, Wilson C, Jilcott-Pitts S. Validation of food store environment secondary data source and the role of neighborhood deprivation in Appalachia, Kentucky. <i>BMC Public Health</i> . 2012;12:688.	InfoUS database to find food outlet addresses, the commercial database to identify food outlets via ground truthing that verify the locations of food outlets. Addresses were categorized based on North American Industry Classification System (NAICS) codes.	Food retail	X	For traditional food outlets, the Positive predictive values (PPV) for smaller non-chain grocery stores was 38%, and large chain supermarkets was 87%. Compared to those with no stores in their neighborhoods, rural residents with a supercenter [OR 0.50 (95% CI 0.27, 0.97)] or convenience store [OR 0.67 (95% CI 0.51, 0.89)] in their neighborhood had lower odds of living in a low deprivation neighborhood relative to a high deprivation.

Gustafson et al, 2017	Gustafson A, Jilcott Pitts S, McDonald J, et al. Direct effects of the home, school, and consumer food environments on the association between food purchasing patterns and dietary intake among rural adolescents in Kentucky and North Carolina, 2017. <i>Int J Environ Res Public Health</i> . 2017;14(10).	Audit tool to quantify the school food environment for competitive foods that used a checklist to assess foods offered at school cafeteria, vending machines to assess healthy vs. unhealthy beverages, and marketing assessed whether fruits and vegetables were available and promoted using posters. Nutrition Environment Measures in Stores, Restaurants, and Convenience Stores for the consumer food environment.	Home; school environments; food retail	X	In vending machines and a la carte, a mean of 20 healthy beverages were available, 51 unhealthy beverages, and 9 healthy snacks and 22 unhealthy snacks. The majority of food, both healthy and unhealthy, was purchased at supermarkets and convenience stores.
Hafoka, 2017	Hafoka SF. Assessing the active living environment in three rural towns with a high proportion of Native Hawaiians and other Pacific Islanders. <i>Health Promot Perspect</i> . 2017;7(3):134-139.	Rural Active Living Assessment (RALA) included the Street Segment Assessment (SSA) that provides a frequency of amenities and facilities of each street segment.	Streets	X	Most (95%) road segments across the three towns had safety features. Two of the three towns had no bike lanes. Town 2 had the most crosswalks (65% of street segments), sidewalk buffers and shoulders (45% of street segments), and route connections (40% of segments).
Hanawa Peterson & Procter, 2019	Hanawa Peterson H, Procter D. A case study of independent grocers in the U.S. rural Midwest. <i>J Hunger Environ Nutr</i> . 2019;14(4):466-489. doi:10.1080/19320248.2018.1434096	Store observation to collect prices and information about stores; survey designed to include items from market basket used in the Thrifty Food Plan for store prices comparisons.	Food retail	X	Our smaller case study stores offer groceries, meat and produce, allocating the selling space in similar proportions with 70–75% of the space to dry grocery goods 10% to meat 5–10% to frozen items, and 5–15% produce. Of the 10 fruits and vegetables with comparable reference prices, only bananas and lettuce were priced higher than the reference prices. In larger communities, the store owners maintained mutually beneficial relationship with local eateries or institutions by offering items at a discount and/or by choosing not to compete with other local businesses.
Hege et al, 2017	Hege A, Christiana RW, Battista R, Parkhurst H. Active living in rural Appalachia: Using the rural active	Rural Active Living Assessment (RALA) included the Town Wide	Recreation facilities; schools;	X	The mean score for proximity to schools was 4.63 out of 15, recreational facilities 21.00 out of 25 and availability and

	living assessment (RALA) tools to explore environmental barriers. <i>Prev Med Rep.</i> 2017;8:261-266.	Assessment that assesses geography and topography features; The Street-segment assessment assesses walkability measures.	streets; sidewalks; trails		access to walking/hiking trails 9.13 out of 20. Towns' walkability from (1-4, with 1 being best) was 2.50. Five of the towns had sidewalks on both sides of the road, eight towns had sidewalks on one side of the road, five towns had intermittent sidewalks, and four towns had no sidewalks. Sidewalks were generally limited and in poor condition, connected to limited walkability
Hill et al, 2012	Hill JL, Chau C, Luebbering CR, Kolivras KK, Zoellner J. Does availability of physical activity and food outlets differ by race and income? Findings from an enumeration study in a health disparate region. <i>Int J Behav Nutr Phys Act.</i> 2012;9:105.	Database of food establishments and PA resources was created. Retail food classified based on the Nutrition Environment Measures Survey (NEMS), walkability index calculated based on work by Saelens et al. (2003) and Frank et al. (2003) geographic information system (GIS). The walkability index made use of publicly available U.S. Census data and road network files.	Food retail; parks; streets; sidewalks	X X	In total, 49 stores, 160 restaurants and 79 PA outlets were enumerated. There were no differences in the number of outlets by block group income or race. Further, spatial analyses suggest that the distribution of outlets is dispersed across all block groups.
Hill et al, 2016	Hill JL, Waters CN, Kolivras KN, Estabrooks PA, Zoellner JM. Do the features, amenities, and quality of physical activity resources differ between city and county areas of a large rural region? <i>Fam Community Health.</i> 2016;39(4):273-282.	Neighborhood Environment Walkability survey (NEWS-A) assesses safety from crime and traffic while walking, PA Resource Assessment (PARA) assess PA outlets by measuring features, amenities, incivilities, and accessibility.	Recreational facilities; parks; streets; sidewalks; schools	X	Results indicated the nearest PA outlet was schools in rural areas, parks were the most prevalent resource overall, rural outlets had a significantly higher count of features compared to urban but also had a higher incivilities count. Nearest PA resource type: park/playground: 25.5%, elementary school: 41%, middle/high school: 16.5%, recreation center: 11.0%.
Honeycutt et al, 2012	Honeycutt S, Carvalho M, Glanz K, Daniel SD, Kegler MC. Research to reality: A process evaluation of a mini-grants program to disseminate evidence-based nutrition programs to rural churches and worksites. <i>J Public Health Manag Pract.</i> 2012;18(5):431-439.	Assessed adoption, reach, implementation, and maintenance of specific programs and their core elements, as well as contextual influences and the resources required to implement the mini-grants program.	Churches; workplace	X	All 4 rural churches and 3 worksites implemented a food related policy change: offering healthy Sunday breakfasts (n=2 churches), establishing a Kitchen Committee policy to offer healthy alternatives at all events, and establishing a policy to serve healthy snacks at a specific youth program. All 4 churches and 2 worksites reported that they will continue the policy and

					environmental changes they started as part of the project.
Hosler et al, 2006	Hosler AS, Varadarajulu D, Ronsani AE, Fredrick BL, Fisher BD. Low-fat milk and high-fiber bread availability in food stores in urban and rural communities. <i>J Public Health Manag Pract.</i> 2006;12(6):556-562.	Trained staff surveyed more than 10 types of food and nonfood items (including presence of fruits and vegetables) and store physical characteristics.	Food retail	X	Stores from rural communities were significantly ( $p < 0.01$ ) more likely to stock low-fat milk (71%) and high-fiber bread (55%) than stores in Albany (40% and 33%, respectively). The rural community also had a significantly higher population ratio of healthy milk & bread stores than Albany (7.6 vs 3.9 per 10,000 residents). Rural healthy milk & bread stores were more likely to be a gas station store than convenience stores and offer off-street parking.
Hosler et al, 2008	Hosler AS, Rajulu DT, Fredrick BL, Ronsani AE. Assessing retail fruit and vegetable availability in urban and rural underserved communities. <i>Prev Chronic Dis.</i> 2008;5(4):A123.	One-page survey assessed more than 10 types of food and nonfood items (including presence of fruits and vegetables) at food retail stores and farmers' markets.	Food retail	X	The weight-adjusted density (per 10,000 residents) of fruit and vegetable stores was 7.8 in Columbia and Greene counties' rural communities ( $P = 0.10$ ), and 9.8 in Columbia and Greene counties' small-town community ( $P = 0.02$ ). Significant differences were not found in fruit-for-snack stores, which ranged from 2.0 per 10,000 in the mixed neighborhood (semi urbanized region) to 3.4 per 10,000 in the rural community.
Hosler, 2009	Hosler AS. Retail food availability, obesity, and cigarette smoking in rural communities. <i>J Rural Health.</i> 2009;25(2):203-210.	Food Availability survey by Albany Prevention Research Center Team included The Priority Food Items group that are recommended by Dietary Guidelines for Americans and the Healthy People 2010; the second group general items were the commonly found food and nonfood items in stores.	Food retail	X	Food stores were assessed in the rural heartland ( $n=112$ ) and the type of food stores in the rural heartland were supermarkets (5.4%), grocery stores (7.1%), farm stores-year-round (5.4%), farm stores-seasonally (3.4%), convenience stores (14.3%), and gas station stores (43.8%). The type of food stores for remote rural mountains were supermarkets (20%), farm stores (0%), farm stores-seasonal (0%), farmers markets (0%), convenience stores (40%), and gas station stores (40%).
Houghtaling, 2020	Houghtaling B, Shanks CB, Ahmed S, Smith T. Resources lack as food environments become more rural: Development and implementation of an Infant Feeding Resource Tool	Infant Feeding Resources Tool (InFeed) measured formulas that contained docosahexaenoic acid and arachidonic acid, vitamin supplements for child-bearing	Food retail	X	For the stores ( $n=21$ ) in rural communities assessed, the equipment score (mostly breastfeeding supportive indicators) was mean = 2.1 (sd 2.2) out of a possible 10 points across all stores. Electronic and manual breast pumps were

	(InFeed). <i>J Hunger Environ Nutr.</i> 2020;15(2):170-189.	aged women, herbal galactagogues believed to aid breastfeeding physiology, equipment available in support of either breast or formula-feeding, and marketing measures respective to each category to capture any influential consumer cues toward breast or formula-feeding.		available in 4.8% and 9.5% of stores, respectively. Equipment scores significantly differed by rurality classification of the community ( $p<0.05$ ).
Hubley, 2011	Hubley TA. Assessing the proximity of healthy food options and food deserts in a rural area in Maine. <i>Applied Geography.</i> 2011;31(4):1224-1231.	The Nutrition Environment Measure Survey (NEMS) tool adapted to create the Maine NEMS (ME-NEMS), which focus on healthy food options.	Food retail	Fruit juice, canned vegetables, whole wheat bread, tuna, milk, and cheese were found to be the most widely available food items in the 50 stores accepting Supplemental Nutrition Assistance Program for the rural towns assessed. Quality was most likely to be acceptable across all the stores. Super stores prices were more consistently lower than the median. Grocery and convenience stores score close together in all areas, except for vegetable prices, where convenience stores score lower.
Izumi et al, 2015	Izumi BT, Findholt NE, Pickus HA. Formative evaluation to increase availability of healthy snacks and beverages in stores near schools in two rural Oregon Counties, 2013. <i>Prev Chronic Dis.</i> 2015;12:E215.	Assessed availability of healthy snacks and beverages in food stores using the SNACZ (Students Now Advocating to Create Healthy Snacking Zones) checklist and conducted in-depth interviews with food store owners.	Food retail	Among the rural study communities, stores (n=15), availability of healthy snacks and beverages was low. Availability of fresh vegetables in single-portion sizes were rare. Across the stores, cherry tomatoes were the only single portion product available. Only a few stores (n=6) carried baby carrots in multiportion bags and bags of apples were not available at any stores, and some stores (n=9) carried bags of oranges.
Jilcott Pitts et al, 2015	Jilcott Pitts SB, Wu Q, Demarest CL, Dixon CE, Dortche CJ, Bullock SL, McGuirt J, Ward R, Ammerman AS. Farmers' market shopping and dietary behaviours among Supplemental Nutrition Assistance	Farmers' market access was quantified as the mean distance (using the road network) from the participants' residential address to all markets that the participants used was	Food assistance programs; food retail	The mean objectively-measured distance to the closest farmers' market (from participants' homes) was 4.5 km (2.8 miles), while the mean objectively-measured distance to the most frequently visited farmers' market was 15.0 km (9.3 miles) and the mean self-reported

	Program participants. <i>Public Health Nutr.</i> 2015 Sep;18(13):2407-14.	calculated using Google Application Programmable Interface (API) and the minimum distance from the residential address to the closest market was calculated using Google API.			distance to the most frequently visited farmers' market was 19.8 km (12.3 miles). In multivariable linear regression analyses, farmers' market shopping was associated with awareness of farmers' markets (estimate=0.18 (se 0.04), $P < 0.0001$ ) but was not significantly associated with age, race, sex, education, distance to farmers' markets or public transportation.
Jilcott Pitts, 2017	Jilcott Pitts SB, Keyserling TC, Johnston LF, et al. Examining the association between intervention-related changes in diet, physical activity, and weight as moderated by the food and physical activity environments among rural, Southern adults. <i>J Acad Nutr Diet.</i> 2017;117(10):1618-1627.	Geographic Information Systems (GIS) was used to measure proximity to food retailers, restaurants, and recreational places. Food Retail Environment Index (mRFEL) measured food environment. Walk Score® measured neighborhood walkability objectively. Objectively-measured crime rates were measured using Crime Reports.	Food retail; parks; recreation facilities; streets	X X	There was an inverse association between weight change and the food environment ( $P = 0.01$ ). There was a positive association between self-reported PA and distance to private gyms ( $P = 0.04$ ) and an inverse association between private gym density and pedometer-measured steps ( $P = 0.03$ ). Results indicated that those living in less favorable food and PA environments had greater improvements in diet, PA and weight, compared to those living in more favorable environments.
Jilcott Pitts, 2018	Jilcott Pitts SB, Wu Q, McGuirt JT, Sharpe PA, Rafferty AP. Impact on dietary choices after discount supermarket opens in low-income community. <i>J Nutr Educ Behav.</i> 2018;50(7):729-735.	Distance from a participant's home address to the primary supermarket was calculated using the Google Distance Matrix application programming interface. The Bridging the Gap Food Store Observation Form (BTG-FSOF) for in store observations.	Food retail	X	Distance to food stores and the consumption of fruits and vegetables was the only significant association, as the more distance for travelling to a grocery store, the lower amounts of fruits and vegetables consumed.
Jilcott Pitts, 2018	Jilcott Pitts SB, Wu Q, Truesdale KP, et al. One-year follow-up examination of the impact of the North Carolina Healthy Food Small Retailer Program on healthy food availability, purchases, and consumption. <i>Int J Environ Res Public Health.</i> 2018;15(12).	Healthy food availability using a validated audit tool, using in store audit Environment Measures Survey for Stores (NEMS-S) that measures the availability, price, quality, and variety of 10 categories of foods and beverages; Customer Intercept Survey consisted of questions frequency of	Food retail	X	In evaluating the Healthy Food Small Retailer Program (HFSRP) intervention outcomes within rural communities, intervention stores (n= 5) and control stores (n= 11), there were statistically significant improvements in healthy food supply scores (availability), with the Healthy Food Supply HFS score being -0.44 points lower in control stores and 3.13 points higher in HFSRP stores pre/post HFSRP ( $p = 0.04$ ). No

		shopping, the availability of fresh fruits and vegetables in the neighborhood, diet assessment using the National Cancer Institute Fruit and Vegetable Screener, Healthy Eating Index from customer “bag checks” to report the healthfulness of fruits and vegetables purchased; validated Veggie Meter device to assess skin carotenoid.			statistically significant changes in purchases or self-reported consumption or skin carotenoids among customers in Healthy Food Small Retailer Program (HFSRP) versus control stores. No significant differences in fruit and vegetable intake, sugary beverage intake, or in skin carotenoids and BMI among customers from HFSRP versus control stores
Jithitikulchai et al, 2012	Jithitikulchai T, Dean WR, Sharkey JR. Variations in the availability and price of healthier food options by store type and urban–rural setting. <i>J Hunger Environ Nutr.</i> 2012;7(4):381-400.	Ground truthed method to identify locations of food stores and classify them; onsite assessment that assessed the availability and price of healthier food items.	Food retail	X	There were small significant differences in availability and average price between rural and urban counties across all store types (n=335). Superstores provided substantially more availability and cheaper healthful foods, especially fresh items. Convenience stores and dollar stores improved the availability of healthier foods in both rural and urban settings. However, the prices offered by convenience stores were considerably higher in general.
Kaczynski et al, 2020	Kaczynski AT, Eberth JM, Stowe EW, et al. Development of a national childhood obesogenic environment index in the United States: Differences by region and rurality. <i>Int J Behav Nutr Phys Act.</i> 2020;17(1):83.	The Childhood Obesogenic Environment Index (COEI) included county-level variables: number of fast-food restaurants, full-service restaurants, grocery stores and supercenters, farmers markets, and convenience stores per 1000 people (U.S. Department of Agriculture), percentage of birth at baby friendly facilities (Centers for Disease Prevention and Control), number of exercise opportunities per 1000 people (County Health Rankings), number of violent crimes per 100,000 people (County	Food retail; hospitals; parks, recreation facilities, schools	X X X	Metropolitan counties in the U.S. had a lower (better) obesogenic environment index score (mean= 46.5, sd= 8.4) than micropolitan (mean= 50.3, sd=8.1) and rural counties (mean=52.9, sd=8.8), with rural areas having the highest (worst) obesogenic environment index. Rural counties in the south had the worst (higher) index scores (mean=55.2, sd=8.7) when compared to all other county classifications.

		Health Rankings), walkability (Environmental Protection Agency), and school proximity (National Center for Education Statistics).		
Katapodis et al, 2019	Katapodis ND, Zhang D, Giabbanelli PJ, Li Y, Lyford CP, Rajbhandari-Thapa J. Evaluating the impact of improving access on consumption of fruits and vegetables in a rural community in Texas: A modeling study. <i>Health Equity</i> . 2019;3(1):382-389.	Secondary data used to measure food accessibility radius to food stores, including square mile, price index of fruit and vegetables, the social influenceability index, and the ratio of unhealthy food outlets to healthy food outlets.	Food retail: Schools	Fruit and vegetable (FV) consumption are sensitive to FV food stores. A one-mile decrease in distance to the closest store in a rural area could result in as much as 8.9% increase in FV consumption. A 5-mile decrease in a rural area could result in a 25% increase in consumption. Decrease in driving distance had a similar effect and previous intervention targeting increased FV access in rural areas have focused on improving nutrition in school lunch programs.
Ko et al, 2018	Ko LK,ENZLER C, PERRY CK, et al. Food availability and food access in rural agricultural communities: Use of mixed methods. <i>BMC Public Health</i> . 2018;18(1):634.	Nutrition Environment Measures Survey (NEMS) to assess the healthfulness of food and beverages in food environments, including NEMS-R to assess the availability, accessibility and affordability of healthy options in restaurants and NEMS-S was used to assess grocery stores and convenience stores' availability, price and quality of healthy options.	Food retail	Grocery and convenience stores (n=32) located in 4 rural towns had low Nutrition Environment Measures Survey scores, indicating low availability of food items, low quality, and high food prices. Composite scores for sit-down restaurants, fast casual restaurants, and fast-food restaurants in rural areas were similarly low in all four towns indicating limited availability of healthy options.
Lu et al, 2017	Lu W, McKyer EL, Dowdy D, et al. Evaluating the influence of the revised Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) food allocation package on healthy food availability, accessibility, and affordability in Texas. <i>J Acad Nutr Diet</i> . 2016;116(2):292-301.	Texas Nutrition Environment Measures Survey of Retail Food Stores, which evaluates WIC authorized food shopping environment (TXNEMS-WIC).	Food retails	Across 105 stores, post-implementation audits showed increased availability in terms of shelf space for fruit (P<0.001), vegetables (P<0.01), cereal (P<0.001), and varieties of vegetables (P<0.001). Food visibility increased for fresh juices (P<0.001). Visibility of WIC labeling improved for fruits (P<0.05), WIC cereal (P<0.05), and whole-grain or whole-wheat bread (P<0.01). Inflation-adjusted

					prices decreased only for bread (P<0.001) and dry grain beans (P<0.001).
Mann et al, 2015	Mann G, Kraak V, Serrano E. The availability of competitive foods and beverages to middle school students in Appalachian Virginia before implementation of the 2014 Smart Snacks in school standards. <i>Prev Chronic Dis.</i> 2015;12:E153.	An adapted protocol to design à la carte foods audits for school vending machine to measure beverages and schools' meals offered through the National School Lunch Program (NSLP)	Schools	X	All rural schools (n=8) offered water. One school also offered juice in 10-ounce portions, and another school offered noncompliant sports drinks. Overall, 36.6% of all à la carte foods and 78.2% of à la carte beverages in each school met all Smart Snacks in School standards. Most foods (85.6%) met ingredient standards and 36.6% of competitive food items were compliant with all Smart Snacks in Schools standards.
Mann et al, 2017	Mann G, Kraak V, Serrano E. Smart snacks in school standards in Appalachian Virginia middle schools. <i>Health Behav Policy Rev.</i> 2017;4(3):245-255.	An adapted protocol to design à la carte foods audits for school vending machine to measure beverages and schools' meals offered through the National School Lunch Program (NSLP)	Schools	X	There was a mean gain in compliance from à la carte foods in rural schools (n=8) of 54.9% (SD 18.4%). All à la carte beverages offered in schools were compliant with the new standards compared to baseline, where an average of 78.2% of beverages adhered to the standards across rural schools that allowed sale of non-compliant fruit beverages (n= 4).
Martínez-Donate et al, 2015	Martínez-Donate AP, Riggall AJ, Meinen AM, et al. Evaluation of a pilot healthy eating intervention in restaurants and food stores of a rural community: A randomized community trial. <i>BMC Public Health.</i> 2015;15:136.	Observation checklist to assess whether the implementation of the intervention activities were on time; owner surveys to evaluate the implementation and maintenance of the Waupaca Eating Smart (WES) intervention, including their intention to continue WES, the impact of implementing WES, and the overall satisfaction.	Food retail	X	On average, 6.3 out of 10 possible intervention activities were implemented in restaurants and 9.0 out of 12 possible activities were implemented in food stores. One month after the end of the pilot implementation period, 5.4 and 7.5 activities were still in place at restaurants and food stores, respectively. Restaurant food environment scores improved from 13.4 to 24.1 (p < 0.01) in the intervention community and did not change significantly in the control community.
Mayo et al, 2013	Mayo ML, Pitts SB, Chriqui JF. Associations between county and municipality zoning ordinances and access to fruit and vegetable outlets in rural North Carolina, 2012. <i>Prev Chronic Dis.</i> 2013;10:E203.	Bridging the Gap Food code/Policy Audit Form to code and score each CTG Project Region 9 county and municipality zoning ordinance.	Food retail	X	There was strong positive correlation between healthful food zoning scores and the number of fruit and vegetable outlets in 13 northeastern rural North Carolina counties (r= 0.66, P=0.01). Major themes in implementation and enforcement of zoning to support fruit and vegetable outlets included strict enforcement versus

					lack of enforcement of zoning regulations.
McCormack et al, 2019	McCormack LA, Eicher-Miller HA, Remley DT, Moore LA, Stluka SR. The development and use of an assessment tool to capture changes in the food pantry nutrition environment and system of food distribution. <i>Transl Behav Med.</i> 2019;9(5):962-969.	MyChoice Scorecards to assess the implementation of the Voices for Food (VFF) Food Pantry Toolkit in each pantry.	Food assistance programs	X	Pre-intervention, MyChoice scores did not differ significantly between intervention and comparison pantries (8.5 ± 1.5 vs. 9.1 ± 1.5, p = .19). Marginal mean values for MyChoice Scorecard score differed significantly between treatment and comparison groups at both mid-intervention (14.6 ± 1.4 vs. 10.8 ± 1.4, p = .05) and post-intervention (21.8 ± 1.2 vs. 11.8 ± 1.2, p < .001).
McDermot et al, 2017	McDermot D, Igoe B, Stahre M. Assessment of Healthy Food Availability in Washington State- Questioning the Food Desert Paradigm. <i>J Nutr Educ Behav.</i> 2017 Feb;49(2):130-136.e1.	Addresses of WIC retailers for 2013 were geocoded by the Washington State Department of Information Resources Management.	Food assistance programs; food retail	X	Nearly all Washington State residents in urban areas lived within a 10-minute drive of a Special Supplemental Nutrition Program for Women, Infant, and Children retailer. Among rural residents, 4.6% were in census blocks outside a 20-minute drive, but the populations were dispersed. Differential access related to income was attributable to a lack of transportation.
McGuirt et al, 2011	McGuirt JT, Jilcott SB, Vu MB, Keyserling TC. Conducting community audits to evaluate community resources for healthful lifestyle behaviors: An illustration from rural eastern North Carolina. <i>Prev Chronic Dis.</i> 2011;8(6):A149.	Windshield tours and ground truthing to identify resources in roads and plan on best routes. A checklist of items to assess during observation, including location, amenities (eg, basketball courts, pools, playgrounds), number of people using the resource, and cleanliness. The second document guided description of community characteristics, an approach previously used: existence of sidewalks, number of fast-food restaurants, the proximity of fast-food restaurants and convenience stores to low-income areas, and the presence of supermarkets or grocery stores.	Food retail; parks; recreation facilities; streets; trails	X X	An initial resource guide was created. When 10 rural North Carolina communities were assessed using the resource guide, 42 resources were identified. Community audits conducted through ground truthing identified an additional 38 resources (for a total of n=80) across all rural communities. Also, 37% of the additional resources were identified by talking with community members and 63% by direct observation. More additional resources were found in rural vs urban towns.

McGuirt et al, 2015	McGuirt JT, Pitts SBJ, Ammerman A, et al. A mixed methods comparison of urban and rural retail corner stores. <i>AIMS Public Health</i> . 2015;2(3):554-582.	Windshield tours to understand food environment and community conditions, store audits using the Nutrition Environment Measures-Stores-Revised (NEMS-S-Rev) to measure the availability, pricing, and quality of foods at food stores. GIS analyses that examines the spatial distribution of food stores.	Food retail	X	Urban stores were more likely than rural to have fresh fruits ( $\chi^2 = 27.0$ ; $p < 0.001$ ) and vegetables ( $\chi^2 = 27.0$ ; $p < 0.001$ ). In the urban setting, corner stores in high income areas were more likely to have fresh fruit ( $\chi^2 = 6.0$ ; $p = 0.014$ ), while in the rural setting, there was no difference between high- and low-income areas. For the urban area, total population, no vehicle and Hispanic population were significantly positively associated ( $p < 0.05$ ), and median household income ( $p < 0.001$ ) and Percent Minority ( $p < 0.05$ ) were significantly negatively associated with corner store count. For the rural areas, total population ( $p < 0.05$ ) and supermarket count were positively associated ( $p < 0.001$ ), and median household income negatively associated ( $P < 0.001$ ), with corner store count.
Michimi & Wimberly, 2010	Michimi A, Wimberly MC. Associations of supermarket accessibility with obesity and fruit and vegetable consumption in the conterminous United States. <i>Int J Health Geogr</i> . 2010;9:49.	2006 Census Zip Code Business Pattern (ZBP) to obtain data on supermarkets and classify them based on employees in food stores; ZIP Code Tabulation Area (ZCTA) to calculate population-weighted mean distance to supermarkets.	Food retail	X	Nonmetropolitan areas (n=267,697) had longer distance to supermarkets compared to metropolitan areas (n=568,584), but distances diminished in some areas as more stores of smaller sizes were included. Population-weighted mean distance to supermarkets: large supermarkets minimum distance: 21.8 km; Large/medium supermarkets: 13.0 km. Large/medium/small supermarkets: 8.4 km.

Michimi & Wimberly, 2012	Michimi A, Wimberly MC. Natural environments, obesity, and physical activity in nonmetropolitan areas of the United States. <i>J Rural Health</i> . 2012;28(4):398-407.	Based on the Recreational Opportunities Index to obtain data from the 1997 National Outdoor Recreation Supply Information System (NORSIS) about 492 outdoor recreation-related variables.	Natural environment; recreational facilities	X	For rural towns, there was a positive correlation between the recreational opportunity and natural amenities indices ( $r=0.460$ ). For the Outdoor Activity Potential measures, 1-unit increases in the recreational opportunity and natural amenities indices were associated with 9% and 8% increases in the odds for PA. For Outdoor Activity Potential measures, 1-unit increases in the recreational opportunity and natural amenities indices were associated with 6% and 9% reductions in the odds for obesity, respectively.
Moore et al, 2013	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. <i>Prev Med</i> . 2013;56(2):145-148.	Home addresses were geocoded using Digital Street and Property Parcel data to measure proximity to nearest public school, restaurants, fast food restaurant, supermarket, and convenience to create a composite distance	Schools; streets	X	The composite distance score was the only significant predictor of MVPA in the rural sample, with BMI percentile and perceptions of high traffic significant in the urban model. The multivariable model for BMI explained a small amount of variance among rural and urban youth ( $R\text{-square}=0.04, .13$ , respectively). Only the presence of “loose or scary dogs” was significantly associated with BMI percentile in urban but not rural youth.
Nanney et al, 2013	Nanney MS, Davey CS, Kubik MY. Rural disparities in the distribution of policies that support healthy eating in U.S. secondary schools. <i>Journal of the Academy of Nutrition and Dietetics</i> . 2013;113(8):1062-1068.	2008 School Health Profiles Principal Survey measuring HE strategies including pricing of healthy snacks and drinks lower in cost and/or low-nutrient, energy-dense snacks and drinks higher in	Schools	X	The likelihood of fruits and/or vegetables being available for purchase from vending machines or school stores was significantly higher in urban and suburban schools than in town/rural schools, was significantly lower at schools with low and medium minority

		cost. Other items that were examined include the availability of fruits and vegetables in school celebrations, availability, purchasing and packaging/ serving size of fruit and vegetables in vending machines or school stores.			enrollment than at schools with highest minority enrollment and was significantly higher at schools with low and medium free/reduced-price meal enrollment than at schools with highest free/reduced-price meal enrollment.
Nanney et al, 2019	Nanney MS, Leduc R, Hearst M, et al. A Group Randomized Intervention Trial increases participation in the School Breakfast Program in 16 rural high schools in Minnesota. <i>J Acad Nutr Diet.</i> 2019;119(6):915-922.	Checklists during breakfast service, including questions on time, location and service type for school breakfast program, availability of vending and other food purchasing options, and whether busses arrived late that day. Data obtained via the school's data management software company to track payments of school meals.	Schools	X	All the intervention schools implemented a grab-n- go menu served outside of the cafeteria setting. All schools implemented a second chance breakfast. Schools went through a process of trial and error to determine the best expanded breakfast setup. Schools reported trying multiple hallway locations, hot versus cold foods, prepackaged meal in a bag versus choice. Breakfast menus at the intervention schools met USDA requirements for meal pattern servings of food groups. The intervention schools implemented at least one marketing and communication strategy.
Nelson et al, 2006	Nelson MC, Gordon-Larsen P, Song Y, Popkin BM. Built and social environments associations with adolescent overweight and activity. <i>Am J Prev Med.</i> 2006;31(2):109-117.	1990 Census information (education, race/ethnicity, poverty housing units, mobility), Standard Industrial Classification code for PA facilities, Federal Bureau of Investigation Uniform Crime Reporting county-level data, U.S. Census TIGER files for road types, walkability, and GIS to reflect residential block groups.	Recreational facilities; parks; sidewalks; streets	X	Neighborhood patterns were identified: rural working class; exurban; newer suburban; upper-middle class, older suburban; mixed-race urban; and low-socioeconomic-status (SES) inner-city areas. Compared to adolescents living in newer suburbs, those in rural working-class (adjusted RR[ARR]=1.38, 95% confidence interval [CI]=1.13–1.69), exurban (ARR=1.30, CI=1.04–1.64), and mixed-race urban (ARR=1.31, CI=1.05–1.64) neighborhoods were more likely to be overweight, independent of individual SES, age, and race/ethnicity.
Nollen et al, 2009	Nollen NL, Befort C, Davis AM, et al. Competitive foods in schools: availability and purchasing in predominately rural small and large	Cross sectional observation of the food environment by collecting food and beverages' information from	Schools	X	Small schools had significantly fewer vending machines than large schools (p<0.01). Vending and a la carte items at small schools contained a median of 2.3

	high schools. <i>J Am Diet Assoc.</i> 2009;109(5):857-864.	all vending machines and the types of foods available at a la carte lunch program.			fewer fat grams per item ( $p \leq 0.05$ ), while vending products contained a median of 25.0 fewer calories per item ( $p \leq 0.05$ ) than at large schools. Desserts, snacks, and sugar sweetened beverages were more stocked and purchased than fruits/vegetables, and dairy in vending machines in both small and large schools.
Novotny et al, 2011	Novotny R, Vijayadeva V, Ramirez V, Lee SK, Davison N, Gittelsohn J. Development and implementation of a food system intervention to prevent childhood obesity in rural Hawai'i. <i>Hawaii Med J.</i> 2011;70(7 Suppl 1):42-46.	Store Visit Process Evaluation form (SVPE) to evaluate the success of keeping promoted items on the shelves, check for proper labeling and posters in stores.	Food retail	X	A high to moderate dose and reach of the overall intervention was achieved in delivery of the cooking demonstrations. Moderate to high fidelity was achieved for educational materials (shelf labels, posters, and educational displays). Posters were found in place 100% of the time. Shelf labels were most often found both in the correct location and intact, though some foods had higher rates of missing/damaged labels or labels incorrectly placed under non-promoted foods.
Pereira et al, 2014	Pereira RF, Sidebottom AC, Boucher JL, Lindberg R, Werner R. Assessing the food environment of a rural community: baseline findings from the heart of New Ulm project, Minnesota, 2010-2011. <i>Prev Chronic Dis.</i> 2014;11:E36.	Nutrition Environment Measures Survey for Restaurants (NEMS-R), which assessed relative healthfulness of menu food items. Nutrition Environment Measures Survey for Stores (NEMS-S), which assessed healthfulness of food items based on fat and calories.	Food retail	X	At least half of the restaurants offered non fried vegetables and 100% fruit juice. Only 32% had at least 1 entrée or 1 main dish salad that met standards for "healthy." Fewer than half (41%) had fruit available and under one-third offered reduced-size portions (29%) or whole-grain bread (26%). Grocery stores had more healthful items available, but findings were mixed on whether these items were made available at a lower price than less healthful items. Convenience stores were less likely to have fruits and vegetables and less likely to carry more healthful products (except milk) than grocery stores.
Perry et al, 2011	Perry CK, Saelens BE, Thompson B. Intrapersonal, behavioral, and environmental factors associated with meeting recommended physical activity among rural Latino youth. <i>Pediatr Exerc Sci.</i> 2011;23(4):521-536.	The Environmental Assessment of Public Recreation Spaces (EAPRS) to assess the quality and amenities of parks in schoolyards.	Parks; schools	X	Thirty-four percent of girls and 41% of boys reported meeting this PA recommendation. Participation in an organized after school activity ( $p < .001$ ) and in physical education (PE) classes 5 days a week ( $p < .001$ ) were strongly associated with meeting recommended

				PA level. Use of higher quality field and court parks was not associated with meeting the recommended level of PA.
Perry et al, 2015	Perry CK, Nagel C, Ko LK, et al. Active living environment assessments in four rural Latino communities. <i>Prev Med Rep.</i> 2015;2:818-823.	Rural Active Living Assessment (RALA) consisted of Town-wide Assessment (TWA) to assess geography, topography and recreational amenities, The Program and Policy Assessment (PPA) assessed community level policies, The Street Segment Assessment (SSA) assessed features of the built environment	Parks; recreation facilities; schools; streets; trails	X Sidewalks in good condition were present in 32% of segments and shoulders in 44% of segments. Half of street segments were rated as walkable. Parks and playgrounds were available; however, half of these were rated in poor condition. All four districts offered after school PA programming but only two had a late bus option. All towns had a public park or playground within a mile of town center, but 3 of 4 were in poor condition. Only 32% road segments had sidewalks in good quality. Safety features were present in 69% segments.
Poulsen et al, 2018	Poulsen MN, Knapp EA, Hirsch AG, Bailey-Davis L, Pollak J, Schwartz BS. Comparing objective measures of the built environment in their associations with youth physical activity and sedentary behavior across heterogeneous geographies. <i>Health Place.</i> 2018 Jan;49:30-38.	Direct observation of the social and physical attributes of study communities was conducted in 2013–2015 by a single trained auditor using the Community Audit of Social, Civil, and Activity Domains in Diverse Environments (CASCADDE) tool. CASCADDE was developed to characterize multidimensional obesity-related environmental features across diverse geographical settings.	Schools; streets; sidewalks, recreational facilities; parks	X In multivariable regression analysis, the odds of active transport were significantly lower in communities with greater DO-barriers scores in boroughs/cities (OR [CI], p-value) (0.16 [0.04, 0.58], 0.005). Among youth in boroughs/cities, sedentary behavior was lower in communities with higher DO-recreation and DO-safety scores (beta [CI], p-value) (DO-recreation: -0.34 [-0.70, 0.02], 0.07; DO-safety: -0.37 [-0.62, -0.11], 0.005). There was no relation between DO-recreation and the number of hours that youth engaged in organized out-of-school PA.
Poulsen et al, 2019	Poulsen MN, Glass TA, Pollak J, et al. Associations of multidimensional socioeconomic and built environment factors with body mass index trajectories among youth in geographically heterogeneous communities. <i>Prev Med Rep.</i> 2019;15:100939.	A theoretically based measurement model, FOOD, measured density, diversity, and accessibility of food outlets, considering all types of food outlets. utilitarian PA favorability (UTIL) characterized utilitarian PA favorability. Fitness and	Food retail; Recreation facilities	X X In townships, utilitarian PA favorability (UTIL), fitness and recreational assets (FIT), and food outlet abundance (FOOD) were significantly and inversely associated with body mass index trajectories after controlling for community socioeconomic deprivation. Across community types, youth in the lowest (versus higher) CSED quartiles had lower BMI at average age and slower

		recreational assets (FIT) characterized the density and diversity of fitness and recreational facilities and the number of parks. A comprehensive panel of 29 candidate indicators was selected from archival data (InfoUSA, Dun & Bradstreet, U.S. Census, Pennsylvania Department of Transportation).		BMI growth, signifying the importance of community deprivation to the obesogenicity of environments.
Powell et al, 2007	Powell LM, Chaloupka FJ, Bao Y. The availability of fast-food and full-service restaurants in the United States: Associations with neighborhood characteristics. <i>Am J Prev Med.</i> 2007;33(4 Suppl):S240-245.	Data on full-service and fast-food restaurant outlets were drawn from a national business list developed by Dun and Bradstreet (D&B). This was linked with Census Data to identify restaurant outlets from the year 2000 under the classification of restaurant outlets.	Food retail	Rural farm areas had less restaurants available. Incidence rate ratio for availability of full-service restaurants in rural areas was 0.22 (95% CI: 0.21,0.22; p<0.01). Incidence rate ratio for availability of fast-food restaurants in rural areas was 0.14 (95% CI:0.14, 0.15; p<0.01). Rural farm areas have less of a need for restaurants and fast food than urban and suburban areas.
Ray et al, 2019	Ray KN, Demirci JR, Uscher Pines L, Bogen DL. Geographic access to International Board-Certified Lactation Consultants in Pennsylvania. <i>J Hum Lact.</i> 2019 Feb; 35(1): 90–99.	Using geographic information systems methodology and a cross-sectional observational design, authors calculated the proportion of young children living within 15, 30, and 60 miles of International Board-Certified Lactation Consultants in Pennsylvania.	Healthcare	In counties with high breastfeeding initiation rates, a larger percentage of children live within 15 miles of an International Board-Certified Lactation Consultant than in counties with low breastfeeding initiation rates. While most Pennsylvania children live in proximity of an International Board-Certified Lactation Consultant, this was true for a lower percentage of children in rural counties and in counties with lower breastfeeding rates.
Rigby et al, 2012	Rigby S, Leone AF, Kim H, et al. Food deserts in Leon County, FL: Disparate distribution of Supplemental Nutrition Assistance Program-accepting stores by neighborhood characteristics. <i>J Nutr Educ Behav.</i> 2012;44(6):539-547.	Census data to identify neighborhood characteristics. Stores list obtained from ReferenceUSA and USDA Southeast Regional Field Office in Atlanta, GA	Food assistance programs; food retail	Of 288 available stores, 45.1% accepted SNAP benefits. Of the 48 neighborhoods, 16.7% had no SNAP-accepting stores. Proportions of SNAP-accepting grocery stores were significantly different by neighborhood racial composition and income. Primarily black neighborhoods did not have any supermarkets. Results

				were mixed with regard to distribution of food stores and SNAP-accepting stores by neighborhood racial composition, income, and rurality.	
Rivera et al, 2018	Rivera RL, Dunne J, Maulding MK, Wang Q, Savaiano DA, Nickols-Richardson SM, Eicher-Miller HA. Exploring the association of urban or rural county status and environmental, nutrition- and lifestyle-related resources with the efficacy of SNAP-Ed (Supplemental Nutrition Assistance Program-Education) to improve food security. <i>Public Health Nutr.</i> 2018 Apr;21(5):957-966.	Metrics to quantify environmental factors including classification of urban or rural county status; the number of SNAP-authorized stores, food pantries and recreational facilities; average fair market housing rental price; and natural amenity rank were collected from government websites and data sets covering the years 2012-2016.	Food assistance programs; food retail	X	None of the environmental factors investigated were significantly associated with changes in household food security in this exploratory study.
Robinson et al, 2014	Robinson JC, Carson TL, Johnson ER, et al. Assessing environmental support for better health: active living opportunity audits in rural communities in the southern United States. <i>Prev Med.</i> 2014;66:28-33.	Rural Active Living Assessment (RALA) tools - street segment assessment (SSA) town-wide assessment (TWA) and policy assessment (PPA)	Playground; parks; streets	X	A total of 117 segments were assessed in 22 towns in 8 counties. Built environmental barriers existed in all communities. Sidewalks were available in only 10-40% of the segments. Town-wide assessments identified parks and playgrounds as the most available community feature. Town program and policies assessment scores indicated few policies for PA outside of school settings with mean scores higher in Mississippi compared to Alabama (61 vs. 49, respectively).
Ruelle et al, 2011	Ruelle, M., Morreale, S. J., & Kassam, K.-A. S. (2011). Practicing Food Sovereignty: Spatial Analysis of an Emergent Food System for the Standing Rock Nation. <i>Journal of Agriculture, Food Systems, and Community Development</i> , 2(1), 163-179.	Quantitative data about voucher issuance and redemption were obtained through a data-sharing agreement with Nutrition for the Elderly and Caregiver Support. Locations of voucher redemptions were tracked and spatially analyzed in a GIS database.	Food assistance program	X	GIS spatial analysis of voucher issuance and redemption patterns reveals that the minimum cost-distance to market explains 33% of variance in voucher redemption. To improve program equity and efficiency, cost-distance models are used to identify potential additional market locations that would reduce the effort associated with trips to market and thus encourage participation.
Rushakoff et al, 2017	Rushakoff JA, Zoughbie DE, Bui N, DeVito K, Makarechi L, Kubo H. Evaluation of Healthy2Go: A	The modified Nutrition Environment	Food retail	X	Stores made inventory changes; installed point-of-purchase educational and in-store marketing materials directing

	country store transformation project to improve the food environment and consumer choices in Appalachian Kentucky. <i>Prev Med Rep.</i> 2017;7:187-192.	Measures Survey-Corner Stores (mNEMS-CS) surveys that include the country store inventory logs which assess the food environment across 4 counties.			shoppers to healthier options; provided nutrition education such as healthy recipes; and altered the display and location of healthy items. Stores increased an average of 11 out of 21 healthy food categories, as well as doubling availability of a variety of fruits, and an increase in variety of vegetables.
Scanlin et al, 2014	Scanlin K, Haardoefer R, Kegler MC, Glanz K. Development of a pedestrian audit tool to assess rural neighborhood walkability. <i>J Phys Act Health.</i> 2014;11(6):1085-1096.	Rural Pedestrian Environment Audit Instrument including 5 domains: destinations, street characteristics, quality of pedestrian facility, aesthetics/quality of environment, social/dynamic environment	Streets; sidewalks	X	In one rural county, people were observed on about 35.3% of the street segments audited, and more often in-town (45.0%) than in out-of-town (13.9%) settings. More than 10 cars were observed on 3.5% of streets and high-speed traffic was observed on 12.2% of the street segments. The predominant land use for 74.1% of the segments was residential buildings and yards. Sidewalks were observed on few segments (13.8%) and were observed only in in-town settings. Few segments (12.1%) included pedestrian crossing aids. Most sidewalks observed were in fair (72.7%) or good (15.2%) condition. On average, the neighborhoods scored 28.75 out of 100.
Sharkey & Scott, 2008	Sharkey JR, Horel S. Neighborhood socioeconomic deprivation and minority composition are associated with better potential spatial access to the ground-truthed food environment in a large rural area. <i>J Nutr.</i> 2008;138(3):620-627.	Data from the 2006 Brazos Valley Food Environment Project (BVFEP), using direct observation and ground-truth methods; GIS (for on-site measurement). Food stores were defined using a modified version of the 2002 North America Industry Classification System definitions. Neighborhood deprivation was determined from socioeconomic characteristics using 2000 census block group (CBG) data. Network distances were calculated from the population-weighted	Food retail	X	The median distance to the nearest supermarket was 14.9 km one way (range 0.12 to 54.0 km). The distance decreased with increasing deprivation, minority composition, and population density. The worst deprived neighborhoods with the greatest minority composition had better potential spatial access to the nearest FS. For >20% of all rural residents, their neighborhoods were at least 17.7 km from the nearest supermarket or full-line grocery or 7.6 km from the nearest convenience store.

		center of each CBG to the nearest supermarket, grocery, convenience, and discount store.		
Sharkey et al, 2011	Sharkey JR, Johnson CM, Dean WR, Horel SA. Association between proximity to and coverage of traditional fast-food restaurants and non-traditional fast-food outlets and fast-food consumption among rural adults. <i>Int J Health Geogr.</i> 2011;10:37.	The Brazos Valley Food Environment Project used ground-truthed methods in a two-stage approach to determine the access to fast food for residents living in the six rural counties.	Food retail	X Increased age, poverty, increased distance to the nearest fast food, and increased number of different traditional fast-food restaurants, non-traditional fast-food outlets, or fast-food opportunities were associated with less frequent weekly consumption of fast-food meals. The interaction of gender and proximity (distance) or coverage (number) indicated that the association of proximity to or coverage of fast-food locations on fast-food consumption was greater among women and opposite of independent effects.
Sharkey et al, 2010	Sharkey JR, Horel S, Dean WR. Neighborhood deprivation, vehicle ownership, and potential spatial access to a variety of fruits and vegetables in a large rural area in Texas. <i>Int J Health Geogr.</i> 2010;9.	Data from the Brazos Valley Food Environment Project (BVFEP) are combined with 2000 U.S. Census data for 101 Census block groups (CBG) to examine neighborhood access to fruits and vegetables. BVFEP data included identification and geocoding of all food stores (n = 185) in six rural counties in Texas, using ground-truthed methods and on-site assessment of the availability and variety of fresh and processed fruits and vegetables in all food stores.	Food retail	X Variety of fruits or vegetables was greater at supermarkets compared with grocery stores. Among non-traditional/convenience food stores, the largest variety was found at dollar stores. On average, rural neighborhoods were 9.9 miles to the nearest supermarket, 6.7 miles and 7.4 miles to the nearest food store with a good variety of fresh fruits and vegetables, respectively, and 4.7 miles and 4.5 miles to a good variety of fresh and processed fruits or vegetables. High deprivation or low vehicle ownership neighborhoods had better spatial access to a good variety of fruits (B-3.09 SE 1.02) P<0.01, and vegetables B -2.91 SE 1.0) P<0.01, both in the distance to and number of shopping opportunities.
Thatcher et al, 2017	Thatcher E, Johnson C, Zenk SN, Kulbok P. Retail food store access in rural Appalachia: A mixed methods study. <i>Public Health Nurs.</i> 2017;34(3):245-255.	Store mapping, ground truthing and in-store food audits using a modified version of the Rudd Center Revised Nutrition Environmental Measure	Food retail	X Supermarkets had better availability of healthful foods, followed by grocery stores, dollar stores, and convenience stores. On average, participants lived within 10 miles of 3.9 supermarkets or grocery stores, and traveled 7.5 miles for major food shopping. Participants

		Survey in Stores (NEMS-S Rudd) to measure the availability, price and quality.		generally shopped at the closest store that met their expectations for food availability, price, service, and atmosphere. Participants' perceptions of stores diverged from each other and from in-store audit findings.
Thomson et al, 2019	Thomson JL, Goodman MH, Landry AS. Assessment of town and park characteristics related to physical activity in the lower Mississippi Delta. <i>Prev Chronic Dis.</i> 2019;16:E35.	Rural Active Living Assessment (RALA), which included the Program and Policy Assessment (PPA) tool, the Town-Wide Assessment (TWA) tool, and the Street Segment Assessment tool to assess physical environment features that affect PA in communities; and the Community Park Audit Tool (CPAT) to assess public parks features, street distance determined using network analysis in ArcGIS	Parks; schools; streets	X Rural Active Living Assessment scores were low with mean values between 0% (town policy) and 68% (parks and playgrounds) of the highest possible scores. The mean (standard deviation) number of parks per town was 2.6 (3.2), and 55% of the 31 parks were in the 2 largest towns. Most parks (87%) had a single amenity while 1 park had more than 4 amenities. Distance from a participant's home to the nearest park ranged from less than 0.1 to 8.8 miles (mean [standard deviation], 1.2 [1.8]).
Thomson et al, 2019	Thomson JL, Goodman MH, Landry AS. Assessment of neighborhood street characteristics related to physical activity in the Lower Mississippi Delta. <i>Health Promot Perspect.</i> 2019;9(1):24-30.	The Street Segment Assessment tool in Rural Active Living Assessment (RALA) to measure Delta Healthy Sprouts participants' neighborhoods	Sidewalks; streets	X Mean street segment length was 0.22 miles (SD = 0.14). All segments had flat terrain with residential (98%), open spaces (74%), and public/civic (34%) as the most prevalent land uses. Almost three-fourths of segments did not have any sidewalks (69%), sidewalk buffers or defined shoulders (73%), crosswalks or pedestrian signage (69%), or posted speed limits (74%). However, 88% had stop signs and almost all (96%) had street lighting and were paved multi lane roads (95%) with low traffic volume (90%). Almost all of the street segments were rated as walkable (99%) and aesthetically pleasing (94%).
Thomson et al, 2020	Thomson JL, Goodman MH, Landry AS. Measurement of nutrition environments in grocery stores, convenience stores, and restaurants in the Lower Mississippi Delta. <i>Prev Chronic Dis.</i> 2020;17:E24.	Nutrition Environment Measures Survey (NEMS) for grocery stores (NEMS-S), (NEMS-CS) for convenience stores and (NEMS-R) for restaurants to measure	Food retail	X Mean Nutrition Environment Measures Survey total ratio scores among food outlets were significantly different from one another except for convenience stores and full-service restaurants. On average, grocery stores had 54% of possible

		the “availability of healthful food choices and quality fresh produce and compares the price of healthful options with the price of less healthful options” (completed by research team)			points, followed by full-service restaurants (21%), convenience stores (16%), and fast-food restaurants (8%). We found no significant differences in mean total ratio scores among convenience store subclasses. For fast food subclasses, stand-alone restaurants had 19% of maximum points possible, significantly higher than grocery store delicatessens (6%), corner stores that sold fast food (3%), and gas stations that sold fast food (4%).
Uscher-Pines et al, 2019	Uscher-Pines L, Ghosh-Dastidar B, Bogen DL, et al. Feasibility and effectiveness of telelactation among rural breastfeeding women. <i>Acad Pediatr.</i> 2020;20(5):652-659.	National Immunization Survey and the Infant Feeding Practices Survey that included an assessment of demographics, employment plans, an obstetric and breastfeeding history, pre-pregnancy health status and breastfeeding attitude	Healthcare	X	Telelactation (e.g., telehealth for BF) using personal electronic devices was tested after postpartum hospitalization for improving breastfeeding duration and exclusivity. Half reported participating in video calls. In general, breastfeeding mothers in the telelactation groups had higher rates of breastfeeding duration and exclusivity, although no differences were found statistically significant from the control groups.
Wallace et al, 2019	Wallace HS, Franck KL, Sweet CL. Community coalitions for change and the policy, systems, and environment model: A Community-Based Participatory Approach to addressing obesity in rural Tennessee. <i>Prev Chronic Dis.</i> 2019;16.	PA Resource Assessment to assess recreational audits. The evaluation team also examined existing data, including recent community needs assessments (conducted within the last 5 years), census data, health department reports, and data available through geographic resource mapping at CommunityCommons.org.	Churches; parks; recreational facilities; food retail; schools	X X	Community Coalitions for Change (C3) increased communities’ capacity for systems change by promoting walking clubs at senior living facilities. The environmental context was the area of greatest change related to PA. Promotional signage was created by state-level content experts in partnership with a contracted marketing firm and then installed in 53 venues in all 4 counties. Four new community parks were created, and PA equipment was installed in 38 venues.
Wells et al, 2008	Wells NM, Yang Y. Neighborhood design and walking. A quasi-experimental longitudinal study. <i>Am J Prev Med.</i> 2008;34(4):313-319.	Geographic Information System (GIS) and Census 2000 data to measure neighborhood type, street-network patterns, and land-use conditions.	Streets	X	Researchers found that pre-move to post move changes in land-use mix and street-network patterns were significant predictors of participants’ post-move walking. In terms of street-network patterns, moving to an area with fewer cul-de-sacs was associated with about

					5303 more steps per week (757 more steps per day).		
Wende et al, 2020	Wende ME, Stowe EW, Eberth JM, et al. Spatial clustering patterns and regional variations for food and physical activity environments across the United States. <i>Int J Environ Health Res.</i> 2020:1-15.	Food environment, county-level variables: number of fast-food restaurants, full-service restaurants, grocery stores and supercenters, farmers markets, and convenience stores per 1000 people (U.S. Department of Agriculture), percentage of birth at baby friendly facilities (Centers for Disease Prevention and Control). PA environment, county-level variables: number of exercise opportunities per 1000 people (County Health Rankings), number of violent crimes per 100,000 people (County Health Rankings), walkability (Environmental Protection Agency), and school proximity (National Center for Education Statistics).	Food retail, hospitals, parks, recreational facilities, schools	X	X	X	Substantial low food score clusters were located in the South and high score clusters in the Midwest and West. Low PA environment score clusters were located in the South and high score clusters in the Northeast and Midwest (p < .0001). For region, the South had significantly lower food and PA environment scores. For rurality, rural counties had significantly higher food environment scores and metropolitan counties had significantly higher PA environment scores (p < .0001).
Wilson et al, 2004	Wilson DK, Kirtland KA, Ainsworth BE, Addy CL. Socioeconomic status and perceptions of access and safety for physical activity. <i>Ann Behav Med.</i> 2004;28(1):20-28.	Established databases from state agencies, global positioning system units to measure trails, sidewalks, public recreation facilities, and violent crime incidents.	Recreation facilities; streets; trails			X	For low SES (vs high SES) groups, there were 22 (vs. 18) recreation facilities, 52 (vs. 48) miles of sidewalks, and 2.5% (vs. 1.8%) of recorded crimes that were classified as violent. However, low-SES respondents had only 2 miles of walking and bicycling trails as compared to high-SES respondents, who had 37 miles of walking and bicycling trails.
Yeager & Gatrell, 2014	Yeager CD, Gatrell JD. Rural food accessibility: An analysis of travel impedance and the risk of potential grocery closures. <i>Appl Geogr.</i> 2014;53:1-10.	Network analysis; first-hand confirmation of food outlet addresses and calculate accessibility to residents.	Food retail			X	The distribution of food outlets was found to be uneven; majority of grocery and convenience stores are in the southern half of the county; only one grocery store was in the northern half. Food locations, such as farmers markets and roadside vegetable markets that are not open all year, were concentrated in the northern half of the county. Several

				food outlets located outside of the county were determined to be accessible to residents of the county.
Yousefian et al, 2010	Yousefian A, Hennessy E, Umstatt MR, et al. Development of the rural active living assessment tools: Measuring rural environments. <i>Prev Med.</i> 2010;50:S86-S92.	Rural Active Living Assessment (RALA) tools include three components: Town-Wide (18 town characteristic questions, and inventory of 15 recreational amenities), Program and Policy (20 questions), and Street Segment (28 questions).	Streets; trails	X We found that the Town-wide and Program and Policy tools were feasible for community members to implement. The RALA tools offer rural researchers and practitioners a resource to assess environments for activity friendliness and inform environmental interventions, programs, and policies to support rural communities in their efforts to promote active living.
Zenk et al, 2015	Zenk SN, Powell LM, Isgor Z, Rimkus L, Barker DC, Chaloupka FJ. Prepared food availability in U.S. food stores: A national study. <i>Am J Prev Med.</i> 2015;49(4):553-562.	Bridge the Gap Food Store Observation Form to measure food and beverages availability in stores.	Food retail	X Rural stores were 26% less likely to carry prepared salads and 14% more likely to carry at least one less-healthy prepared food item. Convenience stores in high-poverty communities were less likely to carry prepared salads than those in low-poverty communities. Among supermarkets, prepared salads were more likely to be carried in majority-white, low-poverty communities than in non-white, high-poverty communities.