BARRIERS AND THE BUILT ENVIRONMENT: AN ASSESSMENT OF PHYSICAL ACTIVITY IN RURAL APPALACHIA

by

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Barriers and the Built Environment: An Assessment of Physical Activity in Rural Appalachia

INTRODUCTION: Physical activity is an important component of health and well-being. It is widely accepted that integrating regular activity into daily life can help lower the risk of developing chronic diseases. Rural populations such as Appalachia suffer from higher rates of obesity, heart disease, and diabetes due to physical inactivity. There is limited available research on rural Appalachian communities and the underlying causes of their disproportionate rates of chronic diseases and low activity levels.

METHODS: This study utilized the Rural Active Living Assessment (RALA) town-wide and street segment features to put quantitative values on physical activity-promoting amenities and features in 16 rural towns in North Carolina. Each town had a population of around 5,000 residents or less.

RESULTS: Analysis of each town-wide assessment revealed the diversity that exists even across rural towns of the same region. Overall, the areas that needed most improvement were the water activities domain and presence of skating rinks or parks. The parks and playground domain scored the best. Specific to street segments, high variability in sidewalk presence and condition was the greatest barrier to active transport.

CONCLUSIONS: The physical activity-promoting features and amenities that rural communities in North Carolina have to offer vary greatly across town borders. Further research should focus on specific policies and programs in place that hinder or promote the use of such recreational facilities. Future interventions should focus first on improving opportunities for activity in central town areas, and then address the issue of connecting scattered residential zones to make all parts of these towns completely accessible.

Introduction

Physical inactivity and public health

The rise of the fast food industry, the use of technology for human convenience, the transition away from a manual labor workforce—there are numerous aspects of modern life that can be blamed for the health concerns plaguing our nation today. There has been a dangerously steady rise in the prevalence of preventable, chronic disease in America within the past few decades—most notably heart disease, type II diabetes, and obesity. Looking at the rise in obesity alone, less than 15% of American adults were obese in 1990 (Center for Disease Control [CDC], 2016), whereas now, nearly three decades later, that percentage has grown to 37%—just over a third of the adult population (CDC, 2016). Apart from high-calorie diets, convenient technologies, and largely sedentary jobs, it is widely accepted that physically inactive lifestyles have played a significant underlying role throughout the development of this chronic disease epidemic. Being physically inactive is now known to be just as much of a risk factor for developing chronic diseases as smoking cigarettes (Robinson et al., 2014). Sedentary lifestyles are also correlated with a higher risk of cancer development (Welch, 2014) and increased morbidity and mortality (Umstattd, Baller, Hennessy, Hartley, & Economos, 2012).

Thus, the promotion of incorporating regular physical activity into everyday lives is a crucial objective of the public health sector today, as increasingly inactive lifestyles have already taken a considerable toll on our population's overall health. In 2007, the American College of Sports Medicine (ACSM) and the American Heart Association (AHA) jointly released an updated version of the physical activity guidelines originally published in 1995. These guidelines recommend that adults participate in aerobic physical activity for at least thirty minutes on five days of each week. However, based on 2015 survey data, only half of American adults self-reported regularly following these

recommended physical activity guidelines (Ward, Clarke, Nugent, Schiller, 2016). Combining this data with the well-known fact that chronic disease is on the rise, it is clear that public health experts and educators have much to improve upon in regards to promoting better health through physical activity, and educating Americans on the important health-related benefits associated with it. In order to address the complexity of the issue, innovative environmental strategies will need to be utilized, acknowledging the various levels of the ecological model that play a role in the overarching problem.

Health in rural America: A look at rural Appalachia

While the rise in obesity and chronic disease as a result of increased physical inactivity is a growing public health concern for the nation as a whole, it has become an increasingly pressing issue in rural America specifically. Based on data from the 1998 National Health Interview Survey, 16% of adults living in rural communities reported themselves as being in a state of poor health, while only 9% of adults living in urban communities reported the same (Eberhardt & Pamuk, 2004). Nearly two thirds (62.8%) of the rural adult population was physically inactive compared to 59.3% of the urban adult population, and 20.4% of adults in rural areas were obese, compared to only 17.8% of their urban counterparts (Patterson, Moore, Probst, & Shinogle, 2004).

Because rural communities are less physically active than urban and suburban communities, they consequently suffer significantly disproportionate burdens of chronic disease (Umstattd et al., 2012). Americans living in rural regions are more likely to die of heart disease, cancer, chronic lower respiratory disease, and stroke than those residing in more urban areas (CDC, 2017). Other chronic conditions, including arthritis and type II diabetes, are also reported more frequently throughout rural communities (Eberhardt & Pamuk, 2004).

In earlier decades, this public health crisis would have been considered an anomaly. Rural communities were once known for their work involving farming and physical labor, and their outdoor-oriented lifestyles (Barnidge et al., 2012). However, drastic changes to the American economy have since left a great dent in the small-scale agricultural workforce, as major industries have made the transition from local, family farms to cheap labor overseas (Lobao & Meyer, 2001). Those populations that were once known for relying on their physical capabilities to make a living are the same populations known for their inactivity today. Americans in rural towns are now less likely to meet the minimum recommended amounts of physical activity, and are more likely to be overweight or obese (Barnidge et al., 2012).

One of the rural regions of America that stand out when studying the consequences of physical inactivity is rural Appalachia. According to the Appalachian Regional Commission (ARC), Appalachia is defined as the "region that follows the spine of the Appalachian Mountains from southern New York to northern Mississippi…[including] all of West Virginia and parts of 12 other states: Alabama, Georgia, Kentucky, Maryland, Mississippi, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, and Virginia." Over 25 million people live within the Appalachian region, making up about 8% of the American population (Pollard & Jacobsen, 2011). Nearly 70% of Appalachian counties are rural (Appalachian Translational Research Network [ATRN], 2012).

Compared to the rest of the nation, the Appalachian population witnesses significantly greater mortality due to coronary heart disease, stroke, and cancer. Coronary heart disease alone causes an average of 20% more deaths in Appalachia than the national average (ATRN, 2012). Furthermore, the highest rates of both diabetes and obesity in the country exist within the Appalachian region. More than 33% of America's "diabetes belt"—

defined by the CDC as a section of the country that has a notably higher percentage of diabetes—is comprised of Appalachian counties (CDC, 2017). Within these counties, diabetes prevalence is at least 10% greater than in areas outside the region (CDC, 2009). Obesity is also 30% more prevalent within Appalachia compared to the national average (CDC, 2009). In addition to higher rates of chronic diseases, Appalachian residents are also less likely to be physically active than the rest of the country. In 2011, the CDC reported that close to 30% of adults in Appalachia spent no time participating in leisure-time physical activity.

These unfortunate statistics reveal the extreme need for extensive research as to the underlying reasons why rural Appalachia experiences such a disproportionate amount of the chronic disease burden seen in America today.

Built Environment and the influence on active living

When beginning to tackle the growing issue of physical inactivity prevalence within particular populations, a variety of contributing factors need to be taken into consideration. One way to organize and properly acknowledge these underlying factors is to look at health as the result of an environmental "riskscape." Viewing health as the result of a riskscape means considering all potential risk factors—genetic, psychological, behavioral, physical and social—that may influence the health outcomes of a population (Ludke & Obermiller, 2012). These factors are integral to the health outcomes of a community, and each must be considered and understood in the appropriate context before potential solutions can be suggested. This study will focus specifically on the physical contributing factors to health—namely, the built environment.

The built environment consists of "the physical parts of where we live and work (e.g., homes, buildings, streets, open spaces, and infrastructure)" (CDC, 2011). This can include anything from recreational facilities and fitness centers to walking trails and playgrounds.

While the built environment does encompass larger infrastructure, it also includes the smaller details of communities and neighborhoods, such as pedestrian crosswalks and safe, well-lit sidewalks.

The CDC has noted the importance of the built environment by stating "stairwells, bicycle paths, walking paths, exercise facilities, and swimming pools that are available, accessible, attractive and safe may play a role in how much and the type of physical activity people engage in" (CDC, 2009). Researchers and educators in public health are only just beginning to examine the significance of the relationship between built environment and physical activity prevalence in communities. One study found that American adolescents living in communities with more recreational facilities were less likely to be obese (Gordon-Larsen, Nelson, Page, & Popkin, 2006). Another study discovered that communities with "parks, play areas, and recreational facilities [are] associated with higher rates of active transportation…and overall physical activity" (Sallis, Floyd, Rodriguez, & Saelens, 2012). This same study noted that the presence of safe sidewalks also correlated with higher physical activity levels. The growing research on this topic has caused the public health sector to begin advocating for improvements in communities' built environments. For example, the Surgeon General's 2015 Call to Action aimed to increase the prevalence of leisure-time activity and active transportation in communities throughout the country, by focusing on enhancing safe and accessible neighborhood features that promote walking.

While our knowledge of the correlation between built environments and physical activity has greatly improved due to recent studies and government initiatives, the benefits of existing research and interventions are largely seen exclusively in suburban and urban communities. Despite the disproportionate chronic disease, obesity and inactivity in rural America, there has been very little research done on the unique effects

that rural built environments may have on physical activity within regions such as Appalachia. One of the overarching goals of Healthy People 2020 is to "eliminate differences in obesity due to geographic location" (Healthy People, 2014). In order to achieve this goal, more attention needs to be paid to the distinctive barriers to physical activity that rural communities face.

The current study

The purpose of this study is to fill the gap in existing knowledge on the relationship between rural Appalachian built environments and physical activity. The study will utilize the Rural Active Living Assessment (RALA) tool, which allows researchers to identify and compare the existing physical features that facilitate physical activity within rural communities, in an attempt to examine the components of the built environment that are unique to rural Appalachia as they relate to physical activity accessibility. In addition to the RALA tool, researchers performed a content analysis to gather further data on the information and resources currently available to this particular population. This study will focus on comparing the varying built environment factors that exist across towns within a diverse selection of Appalachian communities in western North Carolina. By determining the distinct environmental barriers to physical activity residents of rural Appalachia face, we can begin to address this population's overarching issue of obesity and chronic disease at its core.

Methods

Setting

The study's research team began by identifying all rural towns in the western North Carolina region, defining rural as populations smaller than 10,000. There are many rural towns in the Appalachian region of the state, but special geographical circumstances forced researchers to narrow the selection to accommodate the parameters of the study.

For example, many of the rural towns in the mountainous region of the state overlap, making identification of town borders difficult. In addition, several of the towns have no features, amenities or infrastructure to assess at all. The research team included only those rural towns that would be valuable and useful to the project through use of the RALA, resulting in 16 towns within seven counties to be assessed. Table 1 lists the population and area information for each town and county included within the study, as well as each town's general street pattern and topography.

Data Collection

This study made use of the recently developed RALA tool, designed specifically for research within rural communities. While more fully developed and tested urban-based assessment tools exist, these methods are not effective or appropriate for the assessment of rural settings (Umstattd, et al., 2012). The RALA was first piloted in 2008, with the primary goal of becoming an "instrument to assess the most relevant attributes of rural environments for active living" (Yousefian, et al., 2009). The comprehensive tool addresses three different facets of the environment that affect community health: physical, programmatic, and policy. Based on these environmental components, the tool's developers created three different individual assessments, giving researchers the framework to analyze a town's physical amenities, programs and policies, and street segment characteristics (Yousefian, et al., 2009). These include the Segment Assessment (SA) tool, the Program and Policy Assessment (PPA) tool, and the Town-wide Assessment (TWA) tool. The current study did not implement the PPA tool.

The TWA tool looks at town demographics and recreational amenities. The demographics and characteristics portion makes note of town population, town area, topography, general street pattern, and the presence of a distinct town center. It also gives researchers a space to identify any schools within the town limits. The recreational

amenities section assesses any existing walking trails, biking paths, parks, swimming pools, skating rinks, recreation centers, fitness centers, playgrounds, and sports fields or courts. For each amenity, researchers record its distance from the town center, its condition, and its accessibility. Condition is rated as either fair/poor or good/excellent. Accessibility is determined by existence of marked signage, designated parking, and sidewalk connectivity.

The SA tool is centered around street segments within the towns, focusing on both walkability and related land usage. Walkability is determined by assessing various street elements such as sidewalks, buffers and shoulders, crosswalks and pedestrian signs, street safety features, road characteristics, and any existing barriers to walking. Other characteristics such as traffic volume, connectivity, speed limit, and visual aesthetics were also assessed. Land usage is broken up into residential, public, commercial, industrial, and school zones. For both walkability and land usage, researchers were able to mark the condition of each feature as either fair/poor or good/excellent.

Four research team members conducted the data collection for this project between June and August of 2016. Each team member was trained in the use of the RALA tool by the project's lead researcher prior to the data collection process. The developers of the RALA created a codebook describing in further detail each tool and measure, which the research team used as a guide for data collection. Each town was assessed by at least two researchers for reliability. The study involved no interaction with human subjects, so no institutional review was required.

Data Analysis

Scoring for the SA and TWA in this project was based on guidelines created by the RALA developers (Active Living Research, 2009). Guidelines for TWA scoring allowed researchers to obtain scores for both specific amenities and town amenities

overall. Using this tool, each town domain (e.g. schools, trails, parks and playgrounds, water activities, and recreation facilities) could earn individual points based on proximity of included amenities to the town center. The sum of each domain's total scores equaled the town's overall score for physical activity amenities. The higher a town's overall TWA score, the more opportunities it provides for its residents to easily and frequently engage in physical activity. The highest possible score is 100. The SA was scored according to the total number of commercial and public or civic features within each town, with the highest possible score being 11 points. SA scores also took into account the presence or absence of sidewalks and safety features, as well as overall walkability and connectivity of the towns. A bivariate correlation test was used to measure walkability against various town features, concluding in a negative correlation. In this case, a negative correlation indicated a positive outcome, as walkability was rated on a scale of one to four, with one meaning most walkable. Therefore, a greater number of environmental features correlated with a higher level of walkability. SPSS Version 23.0 was used for this analysis (IBM Corp., 2014).

A content analysis is a method of research in which qualitative data is converted into quantitative data through coding. The content analysis included within this study aimed to review sources of town health and wellness information relating to physical activity online, therefore evaluating both the quantity and quality of online resources available to town residents. This added information works alongside the larger portion of the study to give a more complete picture of the active living opportunities that these particular populations have access to. To conduct the content analysis, the research team reviewed the websites of each town and county included within the study, and recorded any information and resources regarding physical activity, recreation, and general health

and wellness that residents have access to. County health department websites were also included in this content analysis.

Results

Demographic information for these populations are based off 2015 American Community Survey data. The populations of the 16 towns within this study ranged from 360 to 5,164, with a mean town population of 2,186. Population densities of each town ranged from 414 per square/mile to 1,013 per square/mile, with a mean town population density of 733 per square/mile. The populations of the seven counties ranged from 10,974 to 82,140, with a mean of 39,200. County population densities ranged from 64 per square/mile to 186 per square/mile, with a mean of 135 per square/mile. Looking at town topography, the majority of towns (12) were described as hilly, while four towns were flat. General town street pattern varied from radial to grid to having no distinguishable pattern. The majority of towns (eight) had radial street patterns, seven had grid patterns, and one town had no distinguishable street pattern. Almost all of the towns (13) had a distinct town center, one of them having multiple town centers. Only three towns had no discernable town center.

Table 1. Demographics

	Alleghany	Ashe	Avery	Caldwell	Mitchell	Watauga	Wilkes
Population	11,155	27,281	17,797	83,029	15,579	51,079	69,340
Banner Elk			1,028				
Blowing Rock						1,241	
Elkin							4,001
Foscoe						1,370	
Granite Falls				4,722			
Hudson				3,776			
Jefferson		1,611					
Linville			647				
Newland			698				
Rhodhiss				1,070			
Sawmills				5,240			
Sparta	1,770						
Spruce Pine					2,175		
Valle Crucis						412	
West Jefferson		1,299					
Wilkesboro							3,413

Table 2. Town and County Characteristics					
	Town Population Density	County Population Density	Town Topography	Presence of Town Center	Town Street Pattern
1 Banner Elk	545 sq/mi	186 sq/mi	Hilly	Yes – 1 distinct	Grid
2 Blowing Rock	414 sq/mi	163 sq/mi	Hilly	Yes – 1 distinct	Grid
3 Elkin	640 sq/mi	70 sq/mi	Hilly	Yes – 1 distinct	Grid
4 Foscoe	N/A	163 sq/mi	Flat	No	Radial
5 Granite Falls	909 sq/mi	176 sq/mi	Hilly	Yes – multiple	Grid
6 Hudson	1,013 sq/mi	92 sq/mi	Flat	Yes – 1 distinct	Radial
7 Jefferson	780 sq/mi	64 sq/mi	Hilly	Yes – 1 distinct	Grid
8 Linville	N/A	186 sq/mi	Hilly	Yes – 1 distinct	Radial
9 Newland	997 sq/mi	47 sq/mi	Hilly	Yes – 1 distinct	Radial
10 Rhodhiss	904 sq/mi	163 sq/mi	Hilly	No	None
11 Sawmills	792 sq/mi	176 sq/mi	Flat	No	Radial
12 Sparta	738 sq/mi	92 sq/mi	Hilly	Yes – 1 distinct	Radial
13 Spruce Pine	557 sq/mi	186 sq/mi	Hilly	Yes – 1 distinct	Radial
14 Valle Crucis	N/A	163 sq/mi	Flat	Yes – 1 distinct	Radial
15 West Jefferson	624 sq/mi	64 sq/mi	Hilly	Yes – 1 distinct	Grid
16 Wilkesboro	620 sq/mi	176 sq/mi	Hilly	Yes – 1 distinct	Grid

The results of the TWA scoring tool revealed that nine of the towns included in this study had no school that residents could walk to. The scores for town school domains ranged from zero to 15, with a mean score of 4.63. The town trail domain scores ranged from four to 17, with a mean score of 9.13. Within the parks and playgrounds in each town, the mean score was 21, with individual town scores ranging from 14 to 25. The water activities domain scores ranged from zero to five, with the lowest mean score of 2.19. Lastly, the mean score for town recreational facilities was 13.13, scores ranging from zero to 26. Overall, TWA scores ranged from 18 to 84 out of 100 possible points, with the overall mean score being 50.06.

Table 3. Town-wide assessment scores						
	School location (15)	Trails (20)	Parks and playgrounds (25)	Water activities (10)	Recreation facilities (30)	**Total Score (100)**
1 Banner Elk	0	9	18	0	11	38
2 Blowing Rock	11	17	25	5	26	84
3 Elkin	15	12	25	5	21	78
4 Foscoe	0	4	14	0	0	18
5 Granite Falls	11	8	23	5	19	66
6 Hudson	0	8	23	4	25	60
7 Jefferson	0	9	20	5	6	40
8 Linville	0	9	15	1	11	36
9 Newland	6	9	23	0	16	54
10 Rhodhiss	0	5	14	1	7	27
11 Sawmills	10	5	20	0	7	42
12 Sparta	10	5	23	4	19	61
13 Spruce Pine	0	16	23	0	9	48
14 Valle Crucis	11	12	23	4	9	59
15 West Jefferson	0	9	24	0	15	48
16 Wilkesboro	0	9	23	1	9	42
Mean Score	4.63	9.13	21.00	2.19	13.13	50.06

Looking at data collected from the SA tool, the amount of commercial features ranged from three to ten, with an average of 6.56. Public and civic town features ranged from two to 11, averaging at 6.69. Focusing on sidewalks specifically, only five towns had sidewalks on both sides of the street, while four towns had no sidewalks at all. The remaining the towns either had sidewalks on only one side of the street or intermittent sidewalks throughout the town. In total, 12 towns had sidewalks, and among these towns, sidewalk conditions varied. Sidewalks were rated to be either in excellent/good condition or fair/poor condition. Seven towns had sidewalks in excellent/good condition, with the remaining five with sidewalks in fair/poor condition. Ten out of the 16 towns had roadside shoulders. Of the towns that had street shoulders, most of them were in excellent/good condition (seven), with three having shoulders in fair/poor condition. Moving onto street safety characteristics, each town could have up to five street safety features. The mean score for this characteristic was 1.38. Traffic volume, characterized as low, medium or high, was medium on average. Four towns had high traffic volume. Any existing barriers were also noted, and towns could have up to five barriers. The mean

score for barriers throughout all 16 towns was 0.94. Lastly, data on street connectivity, walkability, and aesthetics were collected. Seven of the towns were noted to have connectivity. Walkability and aesthetics were rated on a scale of one to 4, with 1 being the most walkable or aesthetic. Average town walkability was rated as 2.5, while average aesthetics of the town was 2.19.

Table 4. Segment assessment characteristics by town (numbered)

	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14	T15	T16	**Mean**
Commercial features	9	5	8	7	9	8	6	8	6	3	3	7	6	3	10	7	6.56
Public/civic features	7	10	9	2	3	7	8	5	10	6	5	11	5	3	7	9	6.69
Sidewalks	1	3	3	0	1	1	1	0	1	0	1	1	2	0	1	2	1.13
Both sides of street	1	1	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0.31
One side of street	0	1	1	0	0	1	1	0	0	0	1	0	1	0	1	1	0.50
Intermittent	0	1	1	0	1	0	0	0	0	0	0	1	1	0	0	0	0.31
Footpath/none	0	0	0	1	0	0	0	1	0	1	0	0	0	1	0	0	0.25
Condition	2	2	2	n/a	1	1	1	n/a	2	n/a	2	2	1	n/a	1	2	1.58
Shoulder	0	2	1	0	2	0	0	0	1	1	1	1	2	0	1	2	0.88
Condition	n/a	2	2	n/a	1	n/a	n/a	n/a	2	1	2	2	2	n/a	1	2	1.70
Safety features	2	3	0	0	3	1	0	2	2	1	2	1	3	0	0	2	1.38
Traffic volume	1	2	2	1	1	3	2	2	1	3	3	2	3	3	2	2	2.06
Barriers present	0	1	2	1	2	1	1	1	1	1	1	0	1	0	1	1	0.94
Connectivity	0	1	1	0	0	1	1	0	0	0	1	0	1	0	1	0	0.44
Walkability	2	1	2	4	2	3	2	3	2	3	3	3	2	3	2	3	2.50
Aesthetics	1	1	2	3	3	3	2	2	2	3	3	3	2	2	2	2	2.19

The content analysis was broken up by health department websites, county websites, and town websites. All seven counties had public websites, eight towns had websites, and the four included health departments all had websites.

Six of the seven county websites contained significant information on the resources their parks and recreation departments had to offer. These resources included organized sports, playing field and court location and availability, parks, recreation centers, public pools, fishing, disc golf, and walking paths. One county had special recreational programs for senior citizens, and another offered Special Olympics. One county even mentioned “fitness walking” on its paved trails, promoting the idea of

walking for exercise. Some counties offered other recreational activities such as hiking, skiing, and golf, based on proximity to popular mountain trails and ski resorts. As far as improving existing programs, one county had published town meeting minutes in which a new swimming pool project grant was discussed, and another county's website had a link for community members to provide input on the county's parks and recreation department. These examples show the progress that some of these counties are making to better existing programs in order to better the health and wellness of the community.

Content analysis by county website				
	Things to do (physical activity related)	Parks & recreation	Health promotion information	Score
Ashe		1		1
Avery	1	1		2
Caldwell				0
Alleghany		1		1
Mitchell		1	1	2
Wilkes		1		1
Watauga		1		1

Content analysis by town website				
	Parks & recreation	Things to do (physical activity related)	Walking information	Score
Linville				0
Banner Elk	1			1
Jefferson	1	1		2
West Jefferson		1		1
Foscoe				0
Valle Crucis	1	1		2
Blowing Rock	1	1		2
Rhodhiss				0
Granite Falls	1		1	2
Wilkesboro	1		1	2
Sparta	1		1	2
Newland				0
Spruce Pine				0
Elkin	1	1		2
Hudson	1			1
Sawmills	1	1		2

Community Health Assessment (CHA) information was present in all four of the health departments' websites. The CHA is a tool designed to allow local health departments and community members to collaborate in order to identify a specific

population's most pressing health concerns and needs, and work together to create sustainable solutions based on available resources and community assets. Within these four health departments, some of the main health concerns based on their respective CHA included chronic disease, substance abuse, physical activity, mental health, childhood obesity, cancer, care for the elderly, and access to health care. One health department's website included a detailed page with information regarding health promotion services provided, which included physical activity education, policy and environmental changes to promote healthy eating and physical activity, comprehensive worksite wellness programs, and preschool and childcare center programs on physical activity. Another health department's website included a separate physical fitness page, describing the various benefits of physical activity in relation to chronic disease prevention and overall health. It even went into further detail explaining the three types of physical activity: aerobic exercise, resistance training, and flexibility exercises.

Two counties' websites made it difficult to locate the link to the corresponding health department. One website had the link on an obscure page titled "Other County-Funded Organizations," which may make it misleading when county residents are attempting to locate the health department link. The other had no health department link on its website at all, although it was a part of a regional department.

Of the towns that did have websites, the majority of the information related to physical activity on these sites had to do with parks and recreation. Most websites had a link for visitors listing things to do in town, including biking, hiking, fishing, canoeing, skiing, and horseback riding. The websites that did offer information on recreational activities were mainly catering towards tourists, not locals. One website did include more information relating to fitness, listing a fitness center that offered "adult running vacations," sports programs, and traditional weight room and cardio equipment. Only one

town's website went into more detail about its resources for local residents through its wellness center, offering further information on community programs such as Eat Smart, Move More and Silver Sneakers.

Discussion

Further interpretation of results

The results of this study reveal that rural towns in the Appalachian mountains of North Carolina are actually very diverse when specific features and characteristics relating to walkability and physical activity are closely examined. Unlike many initial impressions of the region, not every rural town was devoid of safe and accessible environmental features where residents could participate in leisure-time physical activity. The mean score for parks and playgrounds was surprisingly high at 21 out of a possible 25 points. The majority of these parks were in good or excellent condition and within one mile of the town center, allowing for walkability and accessibility. All but two towns in this study had playing fields and courts available to the public, with the exception of one privately owned facility. Further, only three towns had no walking or hiking trails, which can be attributed to the mountainous setting of most of these towns, providing easy access to trailheads.

However, other domains within the TWA tool did not score as well. The domain that scored the worst was water activities at 2.19 out of 10 possible points. The majority of towns did have some sort of water activity-related amenity to offer, but issues such as privately owned facilities and lakes that prohibit swimming were barriers to activity. Another low score was given to the school domain. Out of all 16 towns included in this study, nine had no schools at all. This creates a few issues that affect the children of these rural areas and their opportunities for physical activity. Having to commute to neighboring towns and counties on a daily basis for school excludes the possibility of

children engaging in active transport, such as bicycling or walking to school. Fewer schools in the region also correlate with fewer after school buses, making it more difficult for children who live out of the way and don't have any other source of reliable transportation to participate in extracurricular activities such as school sports.

The average recreational facility score was not as bad as the school or water activity scores, but the TWA data reveals that there is much room for improvement in this category. For example, only five towns had a private fitness facility to offer residents—two of which privately owned by resorts, making them inaccessible to local residents. Further, only three towns offered a recreation center. This is perhaps more worrisome than the amount of private fitness facilities, as town recreation centers are generally more involved with community-wide programs and initiatives that engage and cater to the local residents.

The amenities that received the lowest scores were skate parks and skating rinks. Only two towns had roller skating rinks, one town had an ice-skating rink, and one town had a skate park. The lack of these facilities shows further concern for the younger residents of these communities, as various forms of skating are increasingly popular among today's youth. Without the presence of such facilities that give children a safe outlet to engage in these activities, they may be left to fill their free time with alternative, less active hobbies.

Looking more closely at SA results, a characteristic that has a lot to be improved upon is street walkability and safety. The biggest issue here is the presence of town-wide, continuous sidewalk systems. Four towns had no sidewalk or footpath presence at all, and of the towns that did, sidewalk systems were sporadic, with some parts of town having sidewalks on both sides of the road, one side of the road, and then disappearing altogether. Nine towns were rated to not have any connectivity among its street segments.

Many of the sidewalks were in poor or fair condition, having broken up concrete or being so narrow they seemed as unsafe as walking on the road itself. When town residents have no sidewalks, they must often rely on the presence of shoulders. Six towns had no shoulders alongside of the road, and of the towns that did, three were in fair or poor condition. Many were thin or poorly constructed, making walking along the shoulder dangerous. Take into consideration each town's traffic volume, and walking as a means of transportation is not a safe option for many residents of these towns.

The results of the content analysis were very different among the county and health department websites and individual town websites. Looking at county and health department websites, there was a wealth of information regarding all the potential resources that residents of these communities would have relating to health and wellness. The presence of the CHA in all of the health departments is a promising sign that the communities of this region are embracing the sustainable and useful partnerships that arise when public health experts and community leaders collaborate to solve important issues. Further, apart from the ones already mentioned in the results section that was available on these sites, there were many more resources and useful information listed concerning other health and wellness aspects not directly related to the physical activity and obesity issue discussed in this paper.

On the other hand, the town websites were not as thorough or user-friendly when it came to information about to physical activity opportunities. The only related information available was the parks and recreation department's link, which was in some cases designed to appeal to tourists looking for things to do in the area. Many of the parks and recreation amenities were catered to local residents, such as youth sport programs and greenway trails and walking paths. However, some of the amenities were offered through

private, usually expensive clubs and resorts that cater to tourists, which are not typically used by community members on a regular basis.

Connection to previous work

Previous studies looking at physical activity in rural communities have also utilized the RALA tool. Perry et al. (2015) focused on rural Latino populations in the state of Washington. Their study discovered that amenities in poor condition and in locations not easily accessible were the main issues surrounding physical activity opportunities for this particular population. The results of that assessment were also compared to other previous studies utilizing RALA, finding no significant difference between rural Latino communities in Washington and other rural communities around the country.

Another study by Robinson et al. (2014) used the RALA tool to examine the effects of rural policy and built environment on the health of rural Southern populations, specifically counties in rural Alabama and Mississippi. The results of this audit revealed that every town included in the study had built environments that presented barriers to activity—namely, high variability in sidewalk prevalence. The authors of this study noted the possibility that this variability may be unique to rural communities, due to "scattered residential patterns and lack of community development." The assessment also found that there were very little policies in place in these communities that support physical activity.

One major difference between these prior studies and the current study is the fact that previous audits using the RALA tool incorporated all three assessments, including the Town Program and Policy Assessment (PPA). By incorporating the PPA, researchers were able to add another dimension to the overall assessment by examining the underlying programs and policies in place that affect the prevalence and quality of certain aspects of the built environment. Considering policies already in place and how they either prevent or encourage physical activity is necessary in order to begin the process of

determining what further programs should be implemented within a community. Because most of the barriers to active living opportunities in rural communities occur due to the unique zoning and planning features they posses, recognizing policies that affect things like transportation, connectivity, and future developments is key to tackling these issues.

Until the current study, there has been no work utilizing the RALA or a similar assessment tool to examine the relationship between built environment and physical activity opportunities in rural Appalachia. Because it is the first to address this area specifically, it is challenging to compare the results of this study to previous work without taking into consideration the geographical differences in target population. However, this study aims to shed light on an underserved and under-studied area in need of further research, and implementation of the RALA tool is one step in the right direction leading towards more results that can translate into physical activity programs and interventions in rural Appalachia.

Addressing public health in rural communities

On a larger scale, the results of this study prove that rural communities across America are unique not only when compared to their urban counterparts, but also when compared to each other—rural populations in Washington are not identical to rural populations in Appalachia. However, this study highlighted the same major issue concerning physical activity that appears in rural communities throughout the country: accessibility. Whether rural communities have certain features and amenities catering to physical activity or not, the deciding factor that will determine whether residents choose to engage in such features is their level of accessibility.

In the state of Kentucky, 24% of residents are physically inactive, participating in less than ten minutes of physical activity each week (Welch, 2014). Two of the main barriers to activity that these residents report having are transportation issues and lack of

access to facilities. Rather than lacking the actual facilities that cater to physical activity, these rural communities lack the basic access and transportation features that are necessary for participation and engagement of these facilities. This leads researchers to conclude that addressing issues within the transportation domain of these communities is a top priority. Research supports that transportation in rural communities "must be approached differently than urban transportation…because walking, biking, or even driving by car are not always realistic options" (Yousefian, Ziller, Swartz, & Hartley, 2009). Because programs and amenities supporting physical activity may already exist, the focus should be on increasing access to such programs, allowing a wider range and variety of community members to participate. Such changes should address the environment at both the micro and macro levels, including elements such as after school transportation, connectivity improvements, and mixed-use zoning (Hennessy et al., 2010).

Because what works for urban communities does not always work the same for rural communities, future leaders and planners should focus more on increasing opportunities for activity in daily living. Rural communities are often widespread with residents scattered across a large area, with little land use, zoning, and planning strategies to make the best use of space. Since connectivity is generally already lacking throughout these communities, downtown and central areas should be addressed and changed to allow more opportunities for physical activity in events residents engage in on a daily basis (Yousefian et al., 2009). Installing more walking trails in areas that see high volumes of foot traffic or activity can increase the likelihood that residents will walk more when doing the things they do everyday, such as shopping and running errands. Introducing sidewalk and bike policies in these key areas can increase the chances rural residents will begin incorporating leisure-time physical activity into their day-to-day lives.

Study strengths and limitations

The current study provides previously undocumented information about the physical activity opportunities available to the rural Appalachian community that is necessary for future improvement and progress in the field of public health. Its strengths include the incorporation of a content analysis to examine the online content available to these populations, which can help identify any missing links to the network of health related information that these rural communities require. In addition, use of a valid tool allowed the research team to compare results of the RALA assessment to that of previous work done in different locations. Using a common assessment tool not only helps identify the recurring issues across rural communities that need to be addressed, but also helps identify the weaknesses and strengths of the RALA tool itself, and what can be done to improve its use in the future.

Limitations to the study include the exclusion of the PPA element of the RALA tool. As previously mentioned, past studies that utilized the PPA were able to get a broader sense of physical activity opportunities on both an environmental and public policy scale, which the current study lacks. Another limitation the research team faced was the fact that the RALA tool did not fit every rural town that was originally chosen to study. Many of the rural towns in western North Carolina are so small that they offer no features or amenities whatsoever, which disallows its participation in the audit. As a result, these small communities were left unnoticed. This suggests the possibility that changes may need to be made to the RALA in order to encompass all rural towns, and not only those that already posses features and characteristics that encourage physical activity. If such changes were made, or if a valid assessment tool was created to cater to these smaller towns, they could be incorporated into future studies and researchers could

be able to determine what aspects of such communities need to be addressed first in order to become a community of active living.

Another limitation to the current study is the lack of qualitative data. While the RALA and content analysis together created a helpful picture of what physical activity opportunities and resources look like in these rural Appalachian communities, they both lacked human perception from community members. While the research team could make observations and assumptions based on collected data and completion of the audits, local residents' opinions and thoughts would have been key to truly understanding the community's environment. Hennessy et al. (2010) supports that "qualitative research can provide the missing link between objective measures and health outcomes." It is important for researchers to remember that despite the results of assessments such as the RALA tool, community members' perceptions of the amenities and features in their towns are the true deciding factors in whether or not they will choose to utilize them or not. For example, sidewalks and shoulders leading to facilities may exist, but may not be deemed safe for walking by residents. Another example is if recreational facilities, parks, and trails exist, but are located in parts of town seen as unsafe or dangerous to residents. Such facts would not be uncovered without the help of quantitative data, and tools such as surveys, focus groups, and key informant interviews could provide useful information for further research.

Future Directions

The results of the current study provide many points on which future research can build upon. When continuing to strive to improve physical activity opportunities in rural Appalachia, next steps should involve changes both at the environmental level and the policy level. Ecological models should be applied to encompass the complex relationships between these two levels, allowing for more effective and sustainable approaches (Sallis

et al., 2012). As models that have worked for urban communities in the past might not perform the same in rural communities, researchers and planners should take a different approach when attempting to implement interventions in those areas.

In order to focus on sustainability and long-lasting support for future interventions, emphasis should be placed on existing networks that can be built upon through new partnerships and coalitions to further connect stakeholders throughout the community (Barnidge et al., 2012). Because it can be difficult to convince community members and key informants of the underlying association between policy and health, sustainability of efforts must be of priority so that future interventions and programs do not fall through and disappear when leadership changes occur or program coordination is passed from one programmer to the next.

Future research in this area should focus more on community perspective to lend qualitative support to the existing quantitative data. Conducting focus groups, distributing surveys, and planning key informant interviews can be crucial in uncovering what rural community members truly think of their physical surroundings and how it relates to their ability to achieve active lifestyles. A qualitative data tool to consider utilizing in this geographic location is the Rural Active Living Perceived Environmental Support Scale (RALPESS). The RALPESS "considers unique living environments of rural dwelling families, specifically how church/community/school facilities may influence PA in rural environments (Umstattd et al., 2012)." It allows researchers to not only assess the built environment and what it has to offer in terms of active living, but also the personal opinions of community members regarding their experiences and perceived support for such town features. The RALPESS tool can be used in conjunction with all three components of the RALA tool—especially the PPA tool—to uncover all of the complex and interwoven layers that make up opportunities for healthy living in rural communities.

While the current study sheds a lot of light on the relationship between rural Appalachia's built environments and its populations active living opportunities, there is still much to be done in both the geographic location specifically and the topic in general. More research needs to be done across the country to assess a diverse range of rural communities for comparison, but further insight into the rural Appalachian area specifically is greatly needed for improvements and progress to occur over time. This study serves as a starting point for those future endeavors, giving background information to start with as well as pointing the way towards missing links that have yet to be examined and analyzed. In order to better serve rural Appalachia in the future, public health educators and providers must gain a solid understanding of the strong connection that exists between the health of its environment and the health of its people.

References

Active Living Research. (2009). *Rural Active Living Assessment Tools: Codebook & Scoring.* Portland, ME: Maine Rural Research Health Center, University of Southern Maine.

Appalachian Regional Commission. (2017). The Appalachian Region. Retrieved from https://www.arc.gov/appalachian_region/TheAppalachianRegion.asp

Appalachian Translational Research Network. (2012). Appalachia & Appalachian Health: Quick Facts. Retrieved from https://ccts.osu.edu/sites/default/files/Appalachia%20and%20Appalachian%Health%20Overview%20UPDATED.pdf

Barnidge, E. K., Radvanyi, C., Duggan, K., Motton, F., Wiggs, I., Baker, E. A., Brownson, R. C. (2012). Understanding and addressing barriers to implementation of environmental and policy interventions to support

physical activity and healthy eating in rural communities. *The Journal of Rural Health, 29,* 97-105.

Center for Disease Control. (2009). Physical Activity. Retrieved from https://www.cdc.gov/healthyplaces/healthtopics/physactivity.htm

Center for Disease Control. (2009). Highest Rates of Obesity, Diabetes in the South, Appalachia, and Some Tribal Lands. Retrieved from https://www.cdc.gov/media/pressrel/2009/r091119c.htm

Center for Disease Control. (2011). Highest Rates of Leisure-Time Physical Inactivity in Appalachia and South. Retrieved from https://www.cdc.gov/media/releases/2011/p0216_physicalinactivity.html

Center for Disease Control. (2011). Impact of the built environment on health. Retrieved from https://www.cdc.gov/nceh/publications/factsheets/impactofthebuiltenvironmentonhealth.pdf

Center for Disease Control. (2016). Adult obesity facts. Retrieved from https://www.cdc.gov/obesity/data/adult.html

Center for Disease Control. (2017). Rural Americans at higher risk of death from five leading causes. Retrieved from https://www.cdc.gov/media/releases/2017/p0112rural-death-risk.html

Center for Disease Control. (2017). Appalachian Diabetes Control and Translation Project: The Appalachian Region. Retrieved from https://www.cdc.gov/diabetes/programs/appalachian.html#3

Eberhardt, M. S., Pamuk, E. R. (2004). The importance of place of residence: Examining health in rural and nonrural areas. *American Journal of Public Health 94, 10,* 1682-1686.

Gordon-Larsen, P., Nelson, M. C., Page, P., & Popkin, B. M. (2006). Inequality in the built environment underlies key health disparities in physical activity and obesity. *Pediatrics, 117(2),* 417-424.

Haskell, W. L., Lee, I., Pate, R. R., Powell, K. E., Blair, S. N., Franklin, B.A.,…Bauman, A. (2007). Physical activity and public health: updated recommendations for adults from the American College of Sports Medicine and the American Heart Association. *American Heart Association.* Retrieved from http://circ.ahajournals.org/content/circulationaha/early/2007/08/01/CIRCULTIONAHA.107.185649.full.pdf

Healthy People 2020. (2014). Healthy people 2020 brochure. Retrieved from https://www.healthypeople.gov/sites/default/files/HP2020_brochure_with_LI_508_FNL.pdf

Hennessy, E., Kraak, V., Hyatt, R. R., Bloom, J., Fenton, M., Wagoner, C., & Economos, C. D. (2010). Active living for rural children: community perspectives using PhotoVoice. *American Journal of Preventative Medicine, 39(6),* 537-545.

Lobao, L., & Meyer, K. (2001). The great agricultural transition: crisis, change and social consequences of twentieth century US farming. *Annual Review of Sociology, 27,* 103-124.

Ludke, R. L., Obermiller, P. J. (Eds.). (2012). *Appalachian Health and Well-Being.* Lexington, KY: The University Press of Kentucky.

Patterson, P. D., Moore, C. G., Probst, J. C., & Shinogle, J. A. (2004). Obesity and physical inactivity in rural America. *The Journal of Rural Health, 20,* 151-159.

Perry, C. K., Nagel, C., Ko, L. K., Duggan, C., Linde, S., Rodriguez, E. A., & Thompson, B. (2015). Active living environment assessments in four rural Latino communities. *Preventative Medicine Reports, 2*, 818-823.

Pollard, K., & Jacobsen, L. A. (2011). The Appalachian region in 2010: A census data overview chartbook. Appalachian Regional Commission: CO-16506-09.

Robinson, J. C., Carson, T. L., Johnson, E. R., Hardy, C. M., Shikany, J. M., Green, E., Willis, L. M., Marron, J. V., Li, Y., Lee, C. H., & Baskin, M. L. (2014). Assessing environmental support for better health: Active living opportunity audits in rural communities in the southern United States. *Preventative Medicine, 66,* 28-33.

Sallis, J. F., Floyd, M. F., Rodriguez, D. A., & Saelens, B. E. (2012). The Role of Built Environments in Physical Activity, Obesity, and CVD. *Circulation, 125(5),* 729 737.

Umstattd, M. R., Baller, S. L., Hennessy, E., Hartley, D., & Economos, C. D. (2012). Development of the Rural Active Living Perceived Environmental Support Scale (RALPESS). *Muskie School of Public Service, 4.*

U.S. Census Bureau. (2015). *American Community Survey*. Retrieved from https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml

U. S. Department of Health and Human Services. (2015). *Step It Up! The Surgeon General's Call to Action to Promote Walking and Walkable Communities.* Washington, DC: U. S. Department of Health and Human Services, Office of the Surgeon General.

Ward, B. W., Clarke, T. C., Nugent, C. N., Schiller, J. S. (2016). Early release of selected estimates based on data from the 2015 National Health Interview Survey. *National Center for Health Statistics.* Retrieved from https://www.cdc.gov/nchs/nhis/index.htm

Welch, W. (Ed.). (2014). *Public Health in Appalachia: Essays From the Clinic and the Field.* Jefferson, NC: McFarland & Company, Inc.

Yousefian, A., Hennessy, E., Umstattd, M. R., Economos, C. D., Hallam, J. S., Hyatt, R. R., & Hartley, D. (2009). Development of the rural active living assessment tools: Measuring rural environments. *Preventative Medicine, 50,* S86-S92.

Yousefian, A., Ziller, E., Swartz, J., & Hartley, D. (2009). Active living for rural youth: addressing physical inactivity in rural communities. *Journal of Public Health Management and Practice, 15(3),* 223-231.