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Development of the rural active living assessment tools: Measuring rural environments

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ABSTRACT

Objective. Develop rural-specific assessment tools to be used by researchers and practitioners to measure the activity-friendliness of rural communities.

Method. The tools were created through a mixed-methods investigation into the determinants of physical activity among rural populations. This informed the development of a conceptual framework defining activity-friendly rural environments. Questions were generated to reflect applicable existing urban-based variables and rural conceptual model elements. Pilot testing was conducted in seven rural US communities during the fall of 2008. Inter-rater reliability was assessed.

Results. The 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). We found that the Town-wide and Program and Policy tools were feasible for community members to implement. The observed agreement and κ statistic across all items for the Street Segment Assessment were substantial (91.9% and 0.78, respectively).

Conclusions. The RALA Tools were shown to be feasible and reliability was supported. They assess features believed to be supportive of active living in rural environments, offer users a resource to assess rural environments for activity-friendliness, and may also inform the design of interventions to help rural communities become more active and healthy.

Introduction

The rural United States has seen increasing obesity rates among adults and children since the 1980s (Tai-Seale and Chandler, 2003; Patterson et al., 2004; Jackson et al., 2005; Liu et al., 2008). In 2005, 27.4% of rural adults were obese compared to 23.9% of urban adults (Bennett et al., 2008). Rural children are approximately 25% more likely to be overweight than their metropolitan counterparts (Lutfiyya et al., 2007). One of the factors that may be driving this epidemic in rural settings is a lack of physical activity (Boehmer et al., 2006; Bennett et al., 2008; Martin et al., 2005).

Research on links between the environment and physical activity increased substantially in recent years (Saelens and Handy, 2008). However, the majority of this work has been conducted in urban areas. This makes the generalizability of these findings to rural communities unclear, given that the environmental characteristics relevant to physical activity vary according to climate, landscape, built form, and cultural traditions (Millington et al., 2009). Therefore, research is needed to identify specific aspects of the rural environment that affect physical activity (Dalbey, 2008). One challenge is the lack of environmental measures designed for use in rural settings. To address this gap, we developed, tested, and refined a set of rural-specific assessment tools to aid researchers and practitioners in evaluating the activity-friendliness of rural communities. The purpose of this paper is to describe the development and evaluation of the tools.

Method

This research was conducted through a collaborative effort among three Robert Wood Johnson Foundation (RWJF) Active Living Research (ALR) grantees. One grantee was a partnership between the Universities of Alabama and Mississippi, another grantee was at Tufts University, and one was at the University of Southern Maine (USM; henceforth referred to as the "rural grantees"). The last grantee led the development of the Rural Active Living Assessment (RALA) tools. The Institutional Review Board of each University approved this study.

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The primary goal for developing the RALA tools was to create an instrument to assess the most relevant attributes of rural environments for active living, based on formative research, our conceptual model, and other measures. Another goal was to make the RALA tools feasible for a variety of users to implement and produce data that could be used by researchers and community practitioners.

Context for developing the RALA tools

In a previous round of funding in 2007, each rural grantee conducted a mixed-methods study including surveys, focus groups, key-informant interviews, photo-documentation, and environmental audits to assess factors influencing physical activity among rural populations. This work was conducted in rural Alabama, California, Kentucky, Mississippi, Maine, and South Carolina, with rural defined using either the National Center for Education Statistics' locale codes (National Center for Education Statistics, 2006), Rural-Urban commuting area (RUCA) codes (Economic Research Service, 2000), or Core-Based Statistical Areas (Hall et al., 2006). Each rural grantee independently proposed community selection criteria. The use of different definitions of "rural" reflects the lack of a universal definition and the multidimensional qualities of rural America (Cromartie and Bucholtz, 2008).

Conducting the audits proved challenging, due to unique qualities of the rural landscape. For instance, the physical environment varies significantly across different rural towns. Some have a defined, grid-like town center while others have little or no discernable town center. Features that often exist in urban areas are largely absent in rural settings. Often, rural areas cannot be divided using city blocks or defined neighborhoods, which makes it difficult to define and select street segments to assess. Given these issues, the rural grantees either adapted existing tools and methodologies (Boarnet et al., 2006; Evenson et al.[1]; Lee et al., 2005) or created their own observational instrument to assess the rural built environment.

From the three studies, several factors emerged as consistent themes across all rural areas: aspects of the physical environment (residential density, land use mix, and connectivity of streets and destinations), programmatic environment (programs designed to increase physical activity in the schools, community, or neighboring communities), and policy environment (town- and school-wide policies). Overall, this formative phase highlighted the need to collect information on built environment characteristics as well as rural town settlement patterns, town-wide features and physical activity amenities, and variables related to both transportation and recreation-related activity to understand rural active living opportunities and barriers. The RWJF provided supplemental funding to the rural grantees to create a rural environmental measure, building from this evidence base.

Design of the RALA tools

Designing the RALA tools was an iterative and collaborative process. First, USM developed a rural conceptual model, incorporating key findings from the data collected by the rural grantees in 2007 (Yousefian et al., 2009). This evidence-informed, comprehensive framework includes elements related to three types of environments: physical (density, design, diversity, and perception), programmatic (school- and community-based programs), and policy (transportation, school, community). The grantees used this framework to guide the development of the RALA tools, both in content and format. An initial set of questions was generated reflecting the most applicable urban-based variables and rural conceptual model elements. For instance, low development densities, longer distances, and lack of walking facilities combine in some rural settings to discourage walking as a transportation mode. In our previous study, most rural residents did not report walking or biking to destinations, especially when they lived in a geographically large, dispersed community. However, some residents who lived in or near the town center could walk for transport or leisure because of more street connectivity, sidewalks, and local destinations. Thus, a rural community may be unwalkable for some and walkable for others. We also found that lack of transportation was a significant barrier to recreational physical activity among rural youth, because of the long distance to certain physical activity amenities. Rather than focus on active transport as a means of incorporating physical activity into daily life, we concluded that it may be more relevant to focus on general accessibility to various physical activity programs and amenities by increasing transportation options (Yousefian et al., 2009). This finding is reflected in the RALA tools.

Overall, the RALA tools propose three key elements to capture the activity friendliness of rural communities: broad-level characteristics and recreational amenities, specific programs and policies, and street segment characteristics (Table 1). This three-component package was the result of balancing the need to measure multiple factors with the need for a reliable and user-friendly method that could be utilized by researchers and community members.

Town-wide and Program and Policy Assessments

The Town-wide (TWA) and Program and Policy (PPA) Assessments were informed by our conceptual framework, the Physical Activity Resource Assessment (PARA; Lee et al., 2005), and the "Inventory of Resources Related to Health for Cities and Towns in Vermont" (University of Vermont Center for Rural Studies, 2005). This inventory treats the entire town as the neighborhood. In rural communities, one must assess what is available in the whole town (and sometimes beyond), because community members are often unlikely or unable to walk to destinations and are accustomed to driving long distances to destinations that are important to them (Oleson et al., 2008). Table 1 illustrates the elements included in these assessments.

Street Segment Assessment

The Street Segment Assessment (SSA; Table 1) draws from items included in the Irvine-Minnesota instrument (Day et al., 2006) and a neighborhood audit tool (Evenson et al.) whose development was based on SPACES (Pikora et al., 2002) and a brief urban neighborhood measure (Caughy et al., 2001). From our conceptual model, we eliminated items or constructs found to be irrelevant in rural areas and reduced the number of attributes assessed. This portion of the RALA tools is intended to evaluate the walkability of rural areas and may be most relevant to town centers, developed strips or clusters, or highly resourced areas. Responses vary by element as either categorical (e.g., primary land use is residential, commercial, industrial, public/civic, open space, or other) or ordinal (e.g., traffic volume as high, medium, or low), but the majority are captured as dichotomous choices for presence of the element (yes or no) and condition (fair/poor vs. good/excellent). Perceived walkability and aesthetics of the segment are rated on a 4-point Likert scale.

Codebook Development

The RALA tools Codebook guides users through each assessment. It offers a detailed description of the purpose of the tools and instructions on how to begin thinking about the rural landscape. We describe rural town location patterns as integrated, intermediate, and remote to help auditors understand how town resources (physical amenities, programs, and commerce) are established and what amenities residents have access to within and beyond their town. We define rural town settlement patterns as dispersed, elongated, clustered, and compact to add to the auditor's understanding of walkability and road connectivity. Describing these patterns helps auditors conceptualize their town layout and determine whether it is appropriate to utilize the SSA or only the TWA and PPA. Understanding these patterns will aid in identifying meaningful zones and segment selection, and help identify historic factors that may affect physical activity in the community, such as dispersed community services or inconsistent infrastructure. By recognizing early how the town is laid out and where the town is in relation to other communities, auditors may better understand the "big picture" of their physical environment. These factors are not always recognized through community input alone.

Users are encouraged to select the "Town Central Point," because many questions refer to it. This reference should be determined at the onset of conducting the assessments. In our research, we found landmarks such as the town library, the town hall, or the town green are often representative of what residents consider the center of town. However, some rural communities consist largely of unincorporated areas that lack defined boundaries and/or have no discernable town center. The Codebook provides guidance on how to use the RALA tools with these areas. For instance, assessments may be completed at the county level with the county library, located within the city limits of a county seat, serving as a proxy for the "town center." Selecting a consistent reference point is important because it guides the selection of segments and is the point from which to measure the distance of various physical activity amenities.

[1] Evenson, K.R., Sotres-Alvarez, D., Herring, A.H., Messer, L., Laraia, B.A., Rodriquez, D.A., in review. Assessing street characteristics using a neighborhood audit and GIS: Derivation and reliability of constructs.

Table 1
Overview of the three Rural Active Living Assessment (RALA) tools.

Tool	Town-Wide	Program and Policy	Street Segment
# of questions	33	20	28
Data collection methods	Mail/email/fax to community member(s)	Mail/email/fax to community member(s)	In-person (trained auditors) observation
Elements	**School locations**	**Community Programs**	**Primary Land Use/Terrain**
	Geographic characteristics	*Recreation department*	**Perception of...**
	Facilities	*Walking*	*Walkability*
	Recreation centers (e.g. YMCA)	*Transportation*	*Aesthetics*
	Fitness centers	**Community Policies**	*Traffic volume*
	Physical activity amenities	*Infrastructure*	**Land Use Type/Destinations**
	Trails/Paths	*Snow clearing*	*Residential*
	Recreational areas	**School Programs**	*Residential density*
	Beaches	*Physical activity*	*Public/civic*
	Public Pools	*Walk to school*	*Commercial*
	Rivers/water sport areas	**School Policies**	*School*
	Skating (board, roller, ice)	*Transportation*	*Industrial*
	Parks/playgrounds/sports fields	*Accessibility*	**Walkability**
			Sidewalks
			Buffers/shoulders
			Pedestrian signage
			Safety features
			Road/traffic characteristics
			Barriers
			Connectivity

Note. Street Segment Assessment includes rating items for both presence and condition.
Section headings listed in **bold**; *sub-headings* listed in *italics*.

A sizable portion of the Codebook tells users how to select segments. Although some rural towns have a grid-like town center, these areas are often quite small and do not encompass all "walkable" areas. To address this, we identified four zones to select segments. These zones include the "Town Center," "Thoroughfare," "Neighborhood Cluster," and "Isolated School" (Fig. 1). This description is not intended to be prescriptive, but rather to guide users through the segment selection process. It was important to create these different zones, because in many rural towns assessing walkability may be valuable in areas outside of the town center, such as in areas around schools located on the edges of town or on highways, isolated neighborhoods, or thoroughfares that may connect these areas of interest and/or include retail outlets (e.g., box stores and strip malls used by rural residents). During RALA development, zones were not chosen based on community input, but rather by research staff before reliability testing. This was done, in part, to help refine the Codebook instructions for zone and segment selection.

Depending on the rural town, one may need to select segments from all zones or select segments from just one zone, such as the Town Center. In most cases, segments will fall within a one-mile radius of the town central point, unless there are schools or other significant neighborhoods or thoroughfares that fall outside of that radius. Even with these guidelines, each user selects zones and segments that are most appropriate for his/her community, because rural towns vary in settlement, design, and topography. Similar to the sampling procedure of the Irvine-Minnesota instrument (Day et al., 2006), we aimed to reduce the number of observations while retaining segments with important features that could affect rural active living.

Tool Refinement

In October 2008, USM piloted the RALA tools in four rural Maine communities to ensure usability, length, and appropriateness. For the SSA, a research assistant traveled to three towns to test the segment selection process and complete the audit tool. This process helped ensure question clarity and organization, refined the segment selection procedures and Codebook instructions, and resulted in the removal and addition of indicators. A final pilot test was completed in a fourth rural Maine community to confirm these changes. The TWA and PPA were sent to town officials to gather feedback about their experience using the tools and comments or questions regarding content.

Field testing

Study Setting

RALA tool testing was conducted in seven rural areas during the fall of 2008: three towns in Maine, one each in Mississippi, Alabama, and California; and one county in Kentucky. These were the same rural communities that had been involved in the formative research phase, with the exception of the study sites in California and Kentucky. The same site selection criteria (geographic and economic diversity, topographical variation, and variety in town layout [e.g., presence/absence of town center]) and rural definitions were used (Table 2).

These towns were also chosen, in part, for logistical and feasibility reasons.

Feasibility testing

The TWA and PPA tools were sent to community members considered knowledgeable about the town, to gather their feedback, comments, and questions about the tool's usability and appropriateness. Respondents included town planners, recreation directors, community health advocates, parents, and others. The number of community members initially contacted varied across sites, although in most cases a single respondent was contacted to complete the tools. Respondents were, however, encouraged to contact additional community members to complete the tools, if needed. As with many aspects of the RALA tools, the number of respondents needed to collect adequate data was specific to each rural community, because each town is unique. Respondents were asked to return the tools to their respective research team within a four-week period.

Inter-rater reliability testing

The SSA was assessed for inter-rater reliability. Trained project staff, community members, graduate students, and undergraduates completed this work. It was most efficient to conduct the SSA in pairs. Those who were not familiar with the project and/or audit process were familiarized with the RALA tools during orientation and training sessions. In each community, two auditors pre-selected segments following RALA Codebook processes by using maps printed from Mapquest®, GoogleMaps™, and/or obtained from town or county departments. Once in the field, necessary adjustments to segment boundaries were made, and then each auditor completed a separate SSA. Auditors sent data collection sheets to the USM team for data coding, entry, and analyses.

Statistical analyses

The TWA and PPA were evaluated for their feasibility and not reliability or validity. The inter-rater reliability study for the SSA included 118 street segments across seven rural communities. Reliability was assessed using observed agreement and Cohen's κ statistic. As a guide for interpreting results, we used the ratings developed by Landis and Koch (1977): 0.40–0.59 is moderate inter-rater reliability, 0.60–0.79 substantial, and $\geq$0.80 outstanding. The RALA tools and Codebook are available at www.activelivingresearch.org.

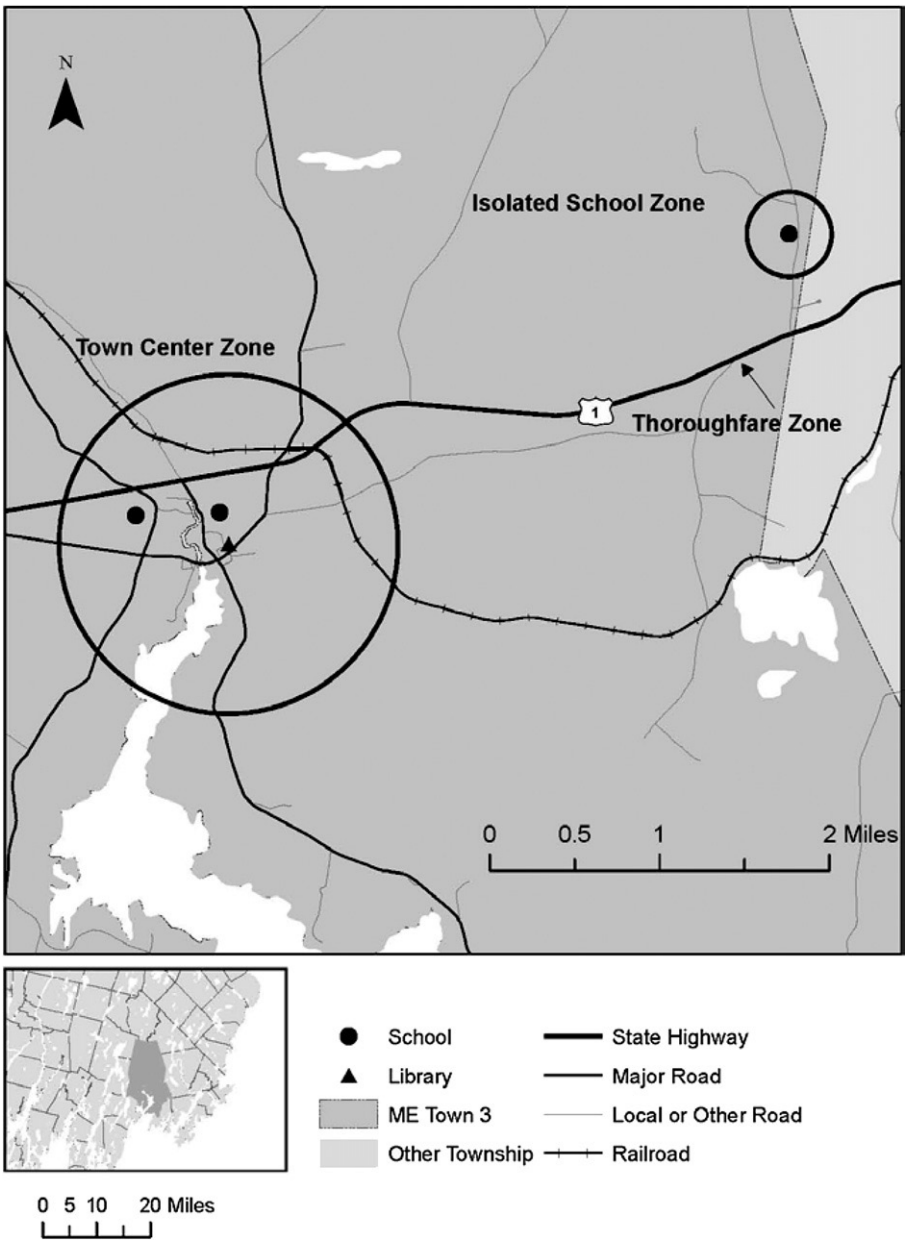

Fig. 1. Location of Town 3 study area in Maine (October 2008) indicating the zones identified using the RALA Codebook. Note. GIS data obtained from the Maine Office of GIS http://megis.maine.gov/ (Accessed 2/2/09).

Results

Table 2 illustrates the variability of the seven rural areas with respect to their characteristics and available amenities identified from the TWA. All of the rural areas had one discernable town center, which served as the reference point from which distance to specific amenities was measured. This variability in responses was also seen in the PPA (Table 3).

For the 118 street segments assessed, the mean administration time was 9.2 minutes (range, 3–25 minutes) per segment. The mean number of segments audited was 17 (range, 7–26). The range in total segments assessed corresponded with rural town size (the fewest segments were audited in the two smallest towns [population and total area] and the most segments were audited in the two largest areas). Overall percent agreement for SSA items was 91.9% and the κ statistic, which accounts for chance agreement, was substantial (0.78, $p<.001$). Table 4 illustrates the percent agreement and κ statistic by element for the objective features (e.g., presence of amenity). The land use elements (school, industrial/agricultural items) exhibited the highest inter-rater reliability (outstanding), while barriers exhibited the lowest (moderate) reliability. The percent agreement for subjective items is shown in Table 5 and the inter-rater reliability for measuring "condition" for most elements was high. The features that had lower agreement included perceived traffic volume, aesthetics, and walkability. The last two elements were rated on a 4-point Likert scale; however, collapsing the scale (strongly agree and agree vs. strongly disagree and disagree) improved the percent agreement (54.2% to 83.9% and 54.2% to 73.7%, respectively).

Discussion

By developing, testing, and refining a rural assessment tool we devised a comprehensive measure addressing many unique factors

Table 2
Descriptive results of selected items from the RALA Town-Wide Assessment.

	Northeast			South			West
	Town 1[a] (ME)	Town 2[a] (ME)	Town 3[a] (ME)	Town 4[b] (MS)	Town 5[b] (AL)	Town 6*[c] (KY)	Town 7[c] (CA)
Population	4,211	6,476	4,916	3,680	3,511	12,401	23,624
Total Area (square miles)	73	37	75	7	11	404	10
Population Density (per square mile)	58	175	66	525	319	31	2362
Topography	Hilly	Flat	Hilly	Hilly	Hilly	Mountains	Flat
Presence of Town Center?	☑	☑	☑	☑	☑	☑	☑
General Street Pattern	No pattern	Radial	Radial	Grid	No pattern	No pattern	Grid
From the town center: Location of…							
Public High School	<1 mi	<1 mi	1–5 mi	<1 mi	<1 mi	1–5 mi	<1 mi
Amenity: Recreational Facility/YMCA	<1 mi	<1 mi	Town has none	<1 mi	Town has none	Town has none	<1 mi
Condition?	2	2	–	1	–	–	2
Clearly marked signs?	☑	☑	–	☑	–	–	No
Designated parking?	☑	☑	–	☑	–	–	No
Sidewalks leading to?	No	☑	–	☑	–	–	☑
Amenity: Public Pool	Town has none	Town has none	Town has none	Town has none	<1 mi	1–5 mi	1–5 mi
Condition?	–	–	–	–	1	2	1
Clearly marked signs?	–	–	–	–	No	No	☑
Designated parking?	–	–	–	–	No	☑	☑
Sidewalks leading to?	–	–	–	–	No	No	☑
Amenity: Biking Paths	<1 mi	Town has none	Town has none	Town has none	Town has none	Town has none	<1 mi
Condition?	2	–	–	–	–	–	2
Clearly marked signs?	☑	–	–	–	–	–	☑
Designated parking?	☑	–	–	–	–	–	☑
Sidewalks leading to?	No	–	–	–	–	–	☑

Note. All data collected from November-December 2008 in the rural United States.
AL, Alabama; CA, California; KY, Kentucky; ME, Maine; MS, Mississippi.
Responses are indicated as follows: yes = ☑, *not applicable* = "–", *2 = Good/Excellent, 1 = Fair Poor.*
The rural definition applied to each town is as follows: [a](Hall et al., 2006), [b](Economic Research Service, 2000), [c](National Center for Education Statistics, 2006).
* Substitute the word "county" for "town".

believed to be important to active living in rural communities. The RALA tools were developed using an evidence-informed framework and substantial input from rural residents, and were designed to balance the needs of practitioners (e.g., user-friendliness) and researchers (e.g., reliable measures). The modules capture specific physical activity amenities, programs and policies, and built environment features. Many of the characteristics of urban and suburban communities shown to be associated with physical activity—aesthetics (Humpel et al., 2002), safety from traffic (Duncan et al., 2005), and destinations (De Bourdeaudhuij et al., 2003; Duncan et al., 2005; Pikora et al., 2006; Saelens et al., 2003; Humpel et al., 2002)—are included in the SSA, but are modified to reflect what is most applicable to rural settings. Certain features (e.g., sidewalk width and material) were excluded, as they were not supported by our formative work, nor did we feel that the amount of time required to record this level of detail was necessary for rural areas.

Limiting the number of questions and technology required for each assessment was an explicit effort to make the RALA tools accessible for local community stakeholders. The RALA tools also complement one another by providing a comprehensive picture of rural physical activity opportunities and barriers and providing a forum for community engagement. Utilizing these tools provides the potential to generate dialogue and impart direction for active living in rural communities. Answering the TWA and PPA invites involvement from officials in planning, public works, parks and recreation, schools, public health, and other areas. Diverse teams are needed to elicit true socioecological improvements to support physical activity (Economos et al., 2007; Nigg et al., 2005) and the RALA tools may help convene and educate such a cross-disciplinary team. Although the usability as an advocacy or planning tool was not formally examined, the tools were designed to assist community members and researchers with assessing the features most relevant to rural physical activity. Similar to the Active Neighborhood Checklist, information generated from the RALA tools could be used to identify targets for change in a community, raise awareness among community members, and mobilize communities to advocate for improving the activity friendliness of their towns (Hoehner et al., 2007).

Study limitations

The RALA tools were tested in seven rural communities of varying size and geographical location. Although findings to date suggest the tools are applicable to many rural settings, generalizability may be limited. The rural areas included were either the same or similar to the rural communities that participated in the formative research phase. In that previous research, grantees identified their own definitions of "rural" when selecting study communities. Testing therefore took place in a variety of rural settings, ranging in both population and total land area. Although it seems unlikely that this would affect the inter-rater reliability of the SSA, it did result in variability in the total number of segments audited across sites.

In previous research, we found that some rural towns are not thorough in plowing snow from roads and sidewalks, making it difficult to assess segments. We attempted to complete testing the RALA tools before large snowfalls; however, one Maine community had an early storm resulting in snow coverage during the SSA audits. This limited the auditors' ability to assess the condition of certain features; however, this should not have affected reliability testing. Seasonal changes and weather conditions may also influence the subjective assessment of segment aesthetics. To address this, we added items to the SSA that capture season and current weather conditions.

We did not develop a formal training process, which may have led to inconsistencies in training across sites. The training needed to use the RALA tools consists of reading through the Codebook to understand town layout, zone and segment selection processes, respondent selection for the TWA and PPA, and item definitions. Since all SSAs were conducted using a common Codebook and many of the items were objective measures, differences in training had minimal effect. However, certain items warrant further investigation as they yielded low reliability estimates. For instance, within the

Table 3
Descriptive results of selected items from the RALA Program and Policy Assessment.

	Northeast				South		West
	Town 1[a] (ME)	Town 2[a] (ME)	Town 3[a] (ME)	Town 4[b] (MS)	Town 5[b] (AL)	Town 6*[,c] (KY)	Town 7[c] (CA)
School-based							
Does the town...							
▪ Have any "Walk to School" programs?	No	☐	☑	No	No	No	☑
▪ Participate in the "Safe Routes to School" program?	☑	☑	☐	No	☐	No	No
Do the public schools…							
▪ Offer any physical activity initiatives for students?	No	☑	☑	No	☐	☑	☑
▪ Allow public access to their recreation facilities after school hours?	☑	☑	☑	No	No	No	No
▪ Have a late bus option for children to stay after school?	No	☑	☑	No	☑	No	☑
Community-based							
Does the town...							
▪ Offer local public transportation options, such as public buses or vans?	No	☑	No	No	☑	No	☑
▪ Regularly clear snow from sidewalks?	☑	☑	No	—	—	—	—
▪ Require bikeways or pedestrian walkways in new public infrastructure projects?	No	☐	No	☑	No	No	☑
▪ Have a public recreation department that offers physical activity programming? *If yes:*	No	☑	☑	☑	☑	No	☑
▪ *Do they offer programming for local youth?*	—	☑	☑	☑	☑	—	☑
▪ *What age range is serviced by these programs?*	—	5–17 y	3–17 y	5–17 y	5–14 y	—	4–17 y
▪ *Do they offer programming for local adults?*	—	☑	☑	No	☑	—	☑
▪ *What age range is served by these programs?*	—	18 + y	18 + y	—	18 + y	—	18 + y
▪ *Are physical activity resources/facilities available for local resident use outside of programming?*	—	☑	No	☐	No	—	☑
▪ *Does the recreation department provide scholarships or offer a sliding fee scale for lower-income residents?*	—	☑	☑	No	No	—	☑

Note. All data collected from November-December 2008 in the rural United States.
AL, Alabama; CA, California; KY, Kentucky; ME, Maine; MS, Mississippi; y, years.
Responses are indicated as follows: yes = ☑, *not applicable* = "–", *don't know* = ☐.
* Substitute the word "county" for "town". The rural definition applied to each town is as follows: [a](Hall et al., 2006), [b](Economic Research Service, 2000), [c](National Center for Education Statistics, 2006).

"Barriers" element, the "Natural Barriers" item yielded a κ statistic of 0.38, indicating that auditors may have been unclear about what constitutes a "natural barrier." Additional training may be necessary for certain elements and items. Subjective measures (e.g., condition of sidewalks, traffic volume, general walkability, and aesthetics) may have been more affected by training differences; however, the Codebook offers detailed guidance, including photos, on completing these measures. During reliability testing, we asked trained staff to provide feedback in refining language in the Codebook to help lessen the need for extensive training among future users. The amount of time it takes each user to read through and process Codebook instructions varies.

Finally, two auditors in each setting conducted SSA audits over the course of one or two days. It is unclear how the RALA instruments would perform if additional auditors conducted the assessments on different days and/or times. For instance, the SSA measures traffic volume that varies by time of day (Hoehner et al., 2007) and should be taken into account by RALA tool users. Also, reliability and validity of the TWA and PPA were not established.

Future research

The present study focused on instrument development, refinement, and inter-rater reliability testing. Additional work is needed to establish validity and to determine which features are correlated with physical activity. Currently, there is no scoring matrix with which to rate the activity friendliness of rural towns, and more work is needed in this area.

The RALA tools are based on our conceptual model (Yousefian et al., 2009) of an activity-friendly rural environment and may not capture

Table 4
Agreement between auditors, as measured by percent agreement and kappa (κ) statistic, for objective items in the RALA street segment assessment.

Element	Inter-rater reliability				
	# of observations	% Agreement (min, max)	κ statistic*		
			Outstanding (>0.80)	Substantial (0.60–0.79)	Moderate (0.40–-0.59)
Primary land use and terrain	1416	92.0 (83.1, 100)		0.68 (0.44, 0.74)	
Walkability					
Sidewalk	590	92.7 (86.4, 94.9)		0.79 (0.56, 0.89)	
Connectivity	118	83.1		0.67	
Buffers/shoulders	354	87.0 (84.7, 89.0)		0.67 (0.62, 0.75)	
Crosswalks/signage	590	90.9 (82.2, 94.1)		0.72 (0.64, 0.79)	
Safety features	708	90.1 (78.8, 100)		0.67 (0.39, 0.75)	
Road/traffic characteristics	472	92.7 (83.5, 100)		0.85 (0.71, 1.0)	
Barriers	826	92.5 (76.9, 99.2)			0.57 (0.38, 0.80)
Land use					
Residential	1062	90.8 (82.2, 97.5)		0.69 (0.44, 1.0)	
Public/civic	1652	95.3 (84.7, 100)		0.72 (0.34, 1.0)	
Commercial	1534	92.4 (83.1, 100)		0.70 (0.54, 1.0)	
Schools	708	96.5 (87.3, 98.3)	0.82 (0.64, 0.94)		
Industrial/agricultural	590	97.5 (94.9. 100)	0.83 (0.66, 1.0)		

* Average across items with κ statistic (min, max). Data reported for 118 segments in 7 rural US communities collected from Nov-Dec. 2008.

Table 5
Agreement between auditors, as measured by percent agreement for subjective items in the RALA street segment assessment.

	% Agreement
Condition of...	
Sidewalks	90.3
Connectors (between roads and segments)	72.0
Buffers/shoulders	83.9
Crosswalks/signage	89.8
Residential buildings/areas	88.6
Public/civic buildings/areas	94.8
Commercial buildings/areas	92.7
School buildings/areas	97.3
Industrial/agricultural buildings/areas	96.8
Perception of...	
Aesthetically pleasing?*	65.3
Walkable?*	54.2
Traffic volume**	70.3

Note. Condition was scored as either 1 = poor/fair or 2 = good/excellent.
Data reported for 118 segments in 7 rural US communities collected from Nov-Dec. 2008.
* Rated on 4-point Likert scale as strongly agree, agree, disagree, strongly disagree.
** Rated as high/medium/low traffic volume.

all aspects relevant to active living. Future research should include more instrument testing in other rural settings (e.g., Great Plains and Southwest) and in communities with diverse populations. This latter aspect is important given the changing demographics of many rural communities (Johnson, 2006; Rural Sociological Society, 2006). Knowing that certain features and elements are not captured in detail, RALA users are encouraged to adapt the instrument as necessary.

Conclusion

This research provides a necessary foundation for future rural active living studies and interventions. 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.

Conflict of interest statement

All authors declare that there is no conflict of interest.

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