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Development and testing of a community audit tool to assess rural built environments: Inventories for Community Health Assessment in Rural Towns

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ABSTRACT

Rural populations face unique challenges to physical activity that are largely driven by environmental conditions. However, research on rural built environments and physical activity is limited by a paucity of rural-specific environmental assessment tools. The aim of this paper is to describe the development and testing of a rural assessment tool: Inventories for Community Health Assessment in Rural Towns (iCHART). The iCHART tool was developed in 2013 through a multistep process consisting of an extensive literature search to identify existing tools, an expert panel review, and pilot testing in five rural US communities. Tool items represent rural built environment features that influence active living and physical activity: community design, transportation infrastructure, safety, aesthetics, and recreational facilities. To assess reliability, field testing was performed in 26 rural communities across five states between July and November of 2014. Reliability between the research team and community testers was high among all testing communities (average percent agreement = 77%). Agreement was also high for intra-rater reliability (average kappa = 0.72) and inter-rater reliability (average percent agreement = 84%) among community testers. Findings suggest that the iCHART tool provides a reliable assessment of rural built environment features and can be used to inform the development of contextually-appropriate physical activity opportunities in rural communities.

1. Introduction

Rural residents in the United States experience notable disparities in health outcomes as compared to their urban and suburban counterparts (Bolin et al., 2015). These disparities are partly driven by environmental factors such as geographic dispersion, lower socioeconomic status (SES), poorer access to recreation facilities, and greater transportation challenges, which restrict opportunities to be active (Yousefian et al., 2009; Seguin et al., 2014; Kegler et al., 2008; Peterson et al., 2013). Existing studies have emphasized the importance of built environment features (e.g. sidewalks, street connectivity, parks) in shaping physical activity behaviors among urban populations (Yousefian et al., 2010; Feng et al., 2010; Frost et al., 2010); however, evidence from rural contexts remains limited (Frost et al., 2010; Comstock et al., 2016; Hansen et al., 2015).

Previous research suggests that built environment features and environmental correlates of physical activity differ between urban and rural areas, further justifying the need for rural-specific measurement approaches (Yousefian et al., 2010; Parks et al., 2003; Wilcox et al., 2000). However, existing rural assessment tools have focused solely on individual street segments (Yousefian et al., 2010; Evenson et al., 2009; Fisher et al., 2010; Scanlin et al., 2014) and require multiple, time-intensive assessments to sufficiently capture the dispersed characteristics of rural communities (Robinson et al., 2014).

One challenge to measuring rural built environment features is the lack of a universal definition of 'rurality' (Yousefian et al., 2010). For the purposes of the current study, we define rural areas as those with a rural-urban community area code of 4 or higher and a population size <10,000 (Hart et al., 2005), encompassing a range of areas from sparsely populated communities to more compact towns. Given the geographic diversity of these communities, assessment tools should be easily adaptable and able to capture the unique features of rural environments (Yousefian et al., 2010).

Recent recommendations for advancing built environment research have called for simplified assessment methods that are feasible for community leaders and residents to use (Glanz et al., 2015). Built environment assessments can inform community programs and policies by identifying areas for improvement and leveraging existing resources. Engaging community residents in these assessments may be an effective strategy to advocate for these changes; however, few rural tools have been developed for this purpose (Buman et al., 2017). To address

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this need, we aimed to develop and test a simplified rural assessment tool for use by community members and researchers alike: Inventories for Community Health Assessment in Rural Towns (iCHART).

2. Methods

2.1. Development of the iCHART tool

2.1.1. Initial iCHART development

A comprehensive literature review was conducted to identify existing objective audit tools for assessing community physical activity environments. Databases searched included the National Collaborative on Childhood Obesity Research (NCCOR) Measures Registry, Active Living Research Tools and Measures (a program of the Robert Wood Johnson Foundation), and PubMed. A total of 88 tools were identified and evaluated based on their content, context, reliability, and validity. Content encompassed the specific built environment features assessed in each tool, such as street connectivity, proximity to exercise facilities, cycling infrastructure, and aesthetics. Context (metro/urban or small town/rural) was defined according to the location in which each tool was administered during its development. Reliability and validity measures were documented when published.

The aim of the current study was to develop a rural assessment tool that could be completed by an independent observer on a single visit. As such, items were selected from existing tools to ensure ease of direct observation and minimize temporal variability in recorded responses. Tools that had been administered in rural settings were prioritized during the iCHART development process. Fig. 1 outlines the steps taken to develop and test the iCHART tool. The initial draft of the iCHART tool contained 273 items organized into 43 elements that represented important features of rural built environments such as street design, sidewalk quality, and community services. Items were directly adopted or modified from nine existing tools (Table 1) (Yousefian et al., 2010; Caughy et al., 2001; Emery et al., 2003; Brownson et al., 2004; Gauvin et al., 2005; Day et al., 2006; Clifton et al., 2007; Hoehner et al., 2007; Chow et al., 2010). A codebook was developed to provide detailed descriptions and photos of each item on the tool. Formatting and structure of the iCHART codebook were based on the Rural Active Living Assessment codebook (Yousefian et al., 2010).

2.1.2. Administration protocol development

The iCHART tool was designed to be administered in two steps: 1) a 1-mile walking tour and 2) a 3.5-mile windshield tour. A windshield tour is a form of direct observation that involves driving around a given location to enumerate specific characteristics (McGuirt et al., 2011). This observational method allows for identification of community characteristics that are either difficult to observe on foot or not within walking distance. Completing the iCHART using both methods would thus provide a more comprehensive assessment of community characteristics than could be observed by walking alone. A field testing instruction manual was created to provide directions for conducting the walking and windshield tours.

2.1.3. Pilot testing and revision

To test and refine the initial iCHART tool, pilot tests were conducted by two research assistants in five rural communities in New York. The research team members were instructed to read through the iCHART tool, codebook, and instruction manual prior to testing. They were also provided with walking and driving routes for each testing location. After each session, they were asked to document any testing difficulties or unclear aspects of the iCHART tool and codebook. Based on this feedback, several items on the initial tool were eliminated (e.g. the choice of "radial" and "grid" community street patterns) and the remaining items were reordered or modified (e.g. "apartments" and "duplexes" were combined into a single item: "rentals"). The revised iCHART consisted of 217 items grouped into 34 elements.

Following pilot testing, the revised iCHART tool and codebook were reviewed by a panel of Extension educators with extensive experience

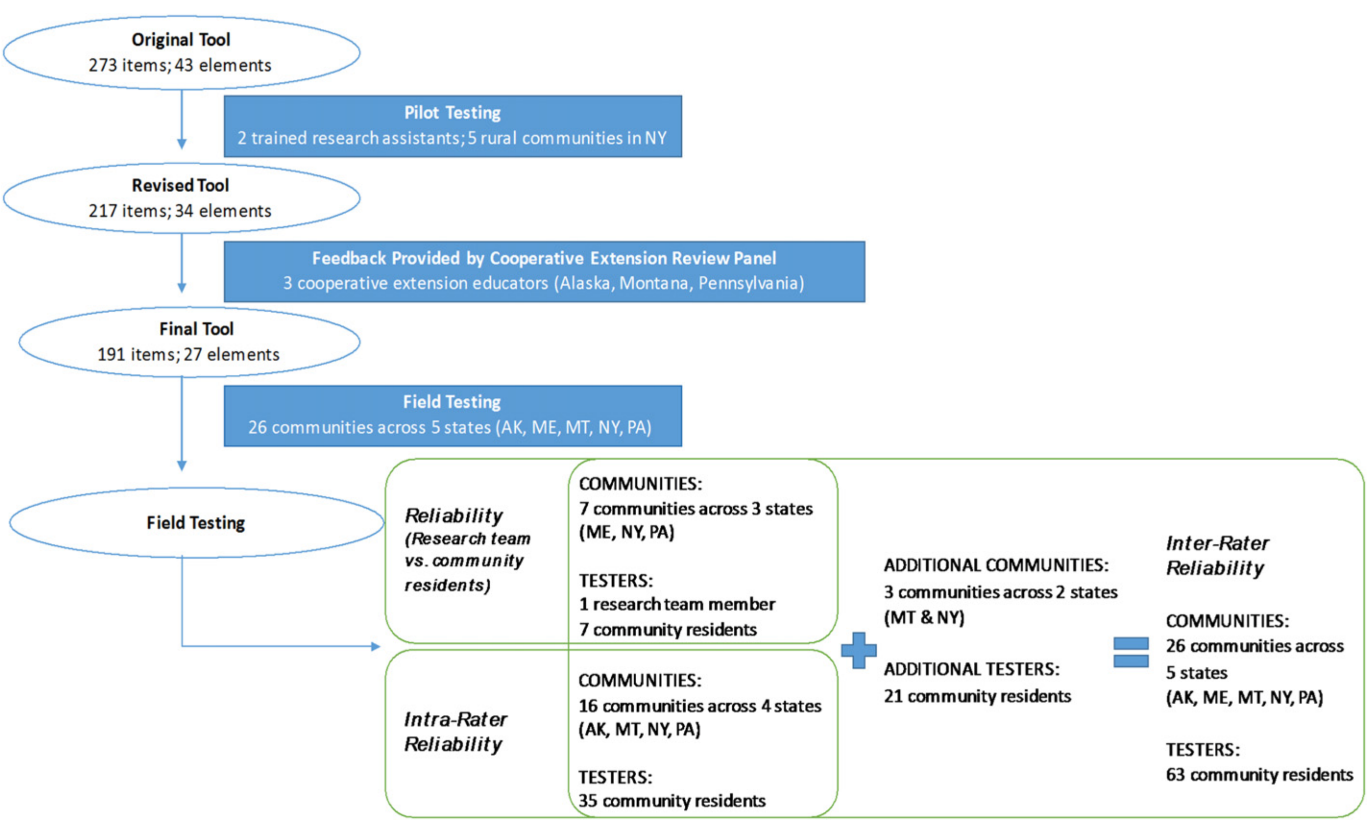

Fig. 1. Steps taken to develop and test the Inventories for Community Health Assessment in Rural Towns (iCHART) tool (July 2013 – November 2014 in the rural United States).

Table 1
Inventories for Community Health Assessment in Rural Towns (iCHART) tool elements and their source instruments.

Tool Element	No. of Items	Source Instrument (s)
Retail businesses	12	Systematic social observation (Caughy et al., 2001)
Non-retail businesses	4	Systematic social observation (Caughy et al., 2001)
Professional services	7	Active Neighborhood Checklist (Hoehner et al., 2007)
Community services	11	Systematic social observation (Caughy et al., 2001) Rural Active Living Assessment (RALA) Segment Assessment Tool (Yousefian et al., 2010)
Food stores/restaurants	3	Active Neighborhood Checklist (Hoehner et al., 2007) RALA Segment Assessment Tool (Yousefian et al., 2010)
Land use	6	Active Neighborhood Checklist (Hoehner et al., 2007)
Arrangement	1	Environmental Profile of a Community's Health (EPOCH) (Chow et al., 2010)
Retail store fronts	1	Neighborhood Active Living Potential (Gauvin et al., 2005)
Amenities	5	Active Neighborhood Checklist (Hoehner et al., 2007)
Physical activity facilities	6	Active Neighborhood Checklist (Hoehner et al., 2007)
Aesthetics	7	Pedestrian Environment Data Scan (PEDS) Tool (Clifton et al., 2007)
Stray animals	1	Analytic Audit Tool (Brownson et al., 2004)
Condition of town center	14	PEDS Tool (Clifton et al., 2007) Irvine-Minnesota Inventory (Day et al., 2006)
Street types	5	Systematic social observation (Caughy et al., 2001)
Intersection Signs	4	PEDS Tool (Clifton et al., 2007)
Street & intersection features	7	Newly created
Speed limits	9	Newly created
Street & intersection safety	18	Irvine-Minnesota Inventory (Day et al., 2006)
Modes of transportation	9	Newly created
Forms of parking	6	PEDS Tool (Clifton et al., 2007) Newly created
Bicycle suitability	12	Bicycling Suitability Assessment Form (Emery et al., 2003)
Sidewalks	15	Active Neighborhood Checklist (Hoehner et al., 2007) PEDS Tool (Clifton et al., 2007)
People	15	Systematic social observation (Caughy et al., 2001) Analytic Audit Tool (Brownson et al., 2004)
Types of housing	4	Active Neighborhood Checklist (Hoehner et al., 2007)
Residential density	3	Irvine-Minnesota Inventory (Day et al., 2006)
Condition of residences	1	Systematic social observation (Caughy et al., 2001)
Overall impression	5	Newly created
Total number of items	191	

working in rural towns. They were asked to assess the tool for clarity and relevance to rural settings and provide feedback on the structure and content of the codebook. All comments were compiled into an excel spreadsheet for review.

Panelist recommendations were discussed by the research team and modifications to the tool were made once consensus was reached. Several features were added to the iCHART tool, such as agricultural and farm stores, vacant lots, and community pools. Most items were modified as suggested (e.g. "condition of non-residential area" was changed to "condition of town center", "community" was changed to "town") and redundant items were removed. Some features suggested by the Cooperative Extension educators (e.g. "brick sidewalks") were not added because they were less commonly observed during pilot testing and could be specified under the "other" category for each tool item. Additional revisions included changes to the tool layout and better clarification of items in the codebook.

2.1.4. Final iCHART tool

Table 1 outlines the specific elements and items included in the final iCHART. The final tool included 191 items grouped into 27 elements. Response categories for most items were dichotomous (i.e. present or absent); however, 12 items were either nominal (>2 unordered categories) or ordinal (more than two ordered categories). The entire tool development process spanned a period of one year, from July 2013 to June 2014.

2.2. Field testing

2.2.1. Study setting

Field testing of the final iCHART tool was conducted in 26 rural communities across five states between July and November of 2014: four communities in Alaska (AK), three communities in Maine (ME), ten communities in Montana (MT), five communities in Pennsylvania (PA), and four communities in New York (NY). Testing locations ranged in population size (<300 residents to 8000 residents), land area, and settlement pattern (dispersed, elongated, and compact) to reflect the diversity of rural settings (Yousefian et al., 2010).

2.2.2. Testing protocol

Testers included a member of the research team (AT) and community residents ($n = 63$) recruited by Cooperative Extension educators and research team members (RS, LC, AT). Community testers were emailed copies of all testing documents (iCHART tool, codebook, and field testing instruction manual) and were instructed to read through all materials prior to testing. Testers were also provided with a brief testing protocol outlining steps for completing the iCHART (e.g. review all three testing documents carefully; schedule 2 h for the first iCHART assessment; only record what features you *observe*).

In addition to the testing documents and protocol, testers were provided with unique walking and driving routes for each testing location, which included a map, written directions, and distance markers. These routes were created to ensure that testers were exposed to the same sections of a given community. The average distance of the walking tours was 1 mile (30-min travel time) and the average distance of the windshield tours was 3.5 miles (20-min travel time). All testers were asked to independently complete the iCHART by following the prescribed walking and driving routes. A single copy of the tool was used to record information from both tours. During the windshield tour, testers were asked to have someone drive them along the route so that they could devote their full attention to completing the iCHART.

2.2.3. Reliability testing between research team member and community testers

To assess reliability between highly trained and minimally trained testers, one member of the research team (AT) completed the iCHART in seven communities (three in ME, two in PA, and two in NY), and her responses were then compared with those from community testers ($n = 7$). Four community testers assessed each of the 3 towns in ME (12 assessments total) while three additional community testers assessed each of the 4 towns in NY and PA (12 assessments total).

A total of 31 assessments were analyzed (seven from the research team member and 24 from the community testers). Since all towns were assessed by multiple community testers, their responses were averaged to create an overall community tester response for each town.

Although kappa is the most commonly used measure of inter-rater reliability, it is influenced by the high prevalence of a single response option (e.g. almost all testers recording a given item as being 'present') (Cohen, 1960; Sim and Wright, 2005). This was relevant to our study as most items on the iCHART tool were binary measures and little variability was observed among testers' responses. Existing methods to adjust kappa values for low variation between testers can only be used when two testers collect the data (Cicchetti and Feinstein, 1990); thus, we used percent agreement as an alternative measure (Boarnet et al., 2006; Malecki et al., 2014).

Only binary items with available data ($n = 179$) were used to calculate the proportion of community testers' responses in exact agreement with the research team member's responses. Percent agreement is less informative for items with polytomous responses because this measure depends on both the number of response categories and the number of testers. Thus, these items were excluded from the analysis. The overall percent agreement for each binary item was calculated by averaging the agreement values from each testing location. Items with 75% or greater percent agreement were considered to be in high agreement (Hartmann, 1977).

2.2.4. Reliability testing among community testers

To assess intra-rater reliability among community testers, 35 community testers completed the iCHART on two separate occasions. Testers were instructed to complete their second iCHART at least seven days after the first. A total of 76 assessments were analyzed from four communities in AK, eight communities in MT, three communities in PA, and one community in NY (Fig. 1).

32 testers completed assessments in a single location (64 assessments) while the remaining 3 testers assessed two different locations (12 assessments).

Due to the low variability of our data, we used a method developed by Cicchetti and Feinstein (Cicchetti and Feinstein, 1990) to calculate adjusted Cohen's kappa values for all binary items on the tool ($n = 179$). To interpret adjusted kappa values: 0.0 to 0.2 indicates slight agreement, 0.21 to 0.40 indicates fair agreement, 0.41 to 0.60 indicates moderate agreement, 0.61 to 0.80 indicates substantial agreement, and 0.81 to 1.0 indicates almost perfect or perfect agreement (Landis & Koch., 1977). Since this method cannot adjust for items with a high prevalence a single response option; percent agreement values were also calculated (Hoehler, 2000).

Finally, completed iCHARTs from 63 community testers were used to assess inter-rater reliability. These included all seven community testers who participated in the reliability testing between the research team member and community testers, all 35 community testers from the intra-rater reliability assessment, and 21 community testers recruited only for inter-rater reliability testing. A total of 103 assessments were analyzed from four communities in AK, three communities in ME, ten communities in MT, five communities in PA, and four communities in NY. Due to the homogeneous nature of our data and the lack of existing methods to adjust data collected by more than two testers, percent agreement values were calculated for each item by dividing the total number of occasions testers agreed by the total number of responses (McHugh, 2012). Overall percent agreement was calculated for all binary items with available data ($n = 179$) by averaging agreement values across all testing locations.

All reliability analyses were conducted using SPSS version 17.0.2 in 2016 and 2017.

3. Results

3.1. Reliability between research team member and community testers

Almost all locations achieved high agreement (75–81%) between the research team member and community testers, except for one town in NY (74%). The average percent agreement across all locations was 77%.

Table 2 presents reliability data by element and includes the number of items assessed within each element. Of the 179 items assessed, 95% attained high agreement (≥75%) between the research team member and community testers. Nine items had low agreement, including two items from *retail businesses* (convenience store, pawn shop), one item from *community services* (municipal building), one item from *land use* (farmland), one item from *aesthetics* (open space), one item from *condition of town center* (vacant buildings), one item from *street and intersection safety* (street view homes), one item from *modes of transportation* (tractors), and one item from *people* (social people) (see Appendix Table A for percent agreement values by item).

Table 2
Aggregated results for reliability between research team member and community testers.

Element	Reliability between research team member and community testers		
	No. of items assessed	% Agreement	
		High[a]	Low[b]
Retail businesses	12	10	2
Non-retail businesses	4	4	0
Professional services	7	7	0
Community services	11	10	1
Food stores/restaurants	3	3	0
Land use	6	5	1
Amenities	5	5	0
Physical activity facilities	5	5	0
Aesthetics	7	6	1
Stray animals	1	1	0
Condition of town center	12	11	1
Street types	5	5	0
Intersection signs	3	3	0
Street & intersection features	7	7	0
Speed limits	9	9	0
Street & intersection safety	18	17	1
Modes of transportation	9	8	1
Forms of parking	6	6	0
Bicycle suitability	10	10	0
Sidewalks	13	13	0
People	14	13	1
Types of housing	4	4	0
Residential density	3	3	0
Overall impression	5	5	0
Total	179	170	9

All data collected from July–November 2014 in the rural United States.
[a] Number of items with percent agreement ≥ 0.75.
[b] Number of items with percent agreement < 0.75.

3.2. Reliability among community testers

Table 3 presents the intra-rater reliability results among community testers by element. Of the 156 items with adjusted kappa values, 83% had almost perfect or substantial agreement. Only six items had low/fair agreement, including one item from *land use* (non-residential), one item from *condition of town center* (road kill), one item from *modes of transportation* (tractors), one item from *bicycle suitability* (bike litter), one item from *sidewalks* (sidewalk concrete), and one item from *people* (skaters) (see Appendix Table B for kappa values by item). Kappa values for 23 items could not be adjusted for high response homogeneity (e.g. presence of trees, sidewalks, handicapped parking); however, these items exhibited high percent agreement (see Appendix Table B for percent agreement values by item). Eighty-three percent of the 179 items with percent agreement values had high agreement (≥75%), similar to our adjusted kappa results.

Inter-rater reliability results among community testers by element are shown in Table 4. Of the 179 items assessed, 94% had high percent agreement (≥75%) between community testers. Eleven items had low agreement, including two items from *land use* (vacant lots and green space), two items from *condition of town center* (litter, unkempt lawns), one item from *street types* (dead ends), one item from *street & intersection features* (dumpsters), one item from *street & intersection safety* (tactile curb cuts), one item from *forms of parking* (handicapped ramps), one item from *bicycle suitability* (bike driveways), one item from *people* (social people), and one item from *residential density* (extensive yard space) (see Appendix Table C for percent agreement values by item).

Table 3
Aggregated results for intra-rater reliability among community testers.

Element	Intra-rater reliability among community testers								
	No. of items assessed	Kappa statistic					No. of items assessed	% Agreement	
		Perfect[c]	Substantial[d]	Moderate[e]	Fair[f]	Slight[g]		High[a]	Low[b]
Retail businesses	12	7	5	0	0	0	12	11	1
Non-retail businesses	3	1	2	0	0	0	4	3	1
Professional services	7	2	4	1	0	0	7	6	1
Community services	11	5	5	1	0	0	11	11	0
Food stores/restaurants	3	2	1	0	0	0	3	3	0
Land use	6	1	3	1	1	0	6	5	1
Amenities	5	1	4	0	0	0	5	5	0
Physical activity facilities	5	2	3	0	0	0	5	4	1
Aesthetics	6	3	2	1	0	0	7	7	0
Stray animals	n/a	–	–	–	–	–	1	1	0
Condition of town center	11	1	9	0	1	0	12	10	2
Street types	4	3	1	0	0	0	5	4	1
Intersection signs	3	0	3	0	0	0	3	3	0
Street & intersection features	6	1	5	0	0	0	7	6	1
Speed limits	6	4	1	1	0	0	9	9	0
Street & intersection safety	15	5	9	1	0	0	18	16	2
Modes of transportation	8	1	4	2	1	0	9	8	1
Forms of parking	5	2	1	2	0	0	6	4	2
Bicycle suitability	8	0	3	4	1	0	10	9	1
Sidewalks	13	2	10	0	1	0	13	8	5
People	9	0	4	4	1	0	14	8	6
Types of housing	3	1	2	0	0	0	4	3	1
Residential density	3	2	0	1	0	0	3	3	0
Overall impression	4	0	2	2	0	0	5	2	3
Total	156	46	83	21	6	0	179	149	30

All data collected from July–November 2014 in the rural United States.
[a] Number of items with percent agreement ≥ 0.75.
[b] Number of items with percent agreement < 0.75.
[c] Perfect agreement = 0.81–1.00.
[d] Substantial agreement = 0.61–0.80.
[e] Moderate agreement = 0.40–0.60.
[f] Fair agreement = 0.21–0.40.
[g] Slight agreement = 0.0–0.20.

Table 4
Aggregated results for inter-rater reliability among community testers.

Element	Inter-rater reliability among community testers		
	No. of items assessed	% Agreement	
		High[a]	Low[b]
Retail businesses	12	12	0
Non-retail businesses	4	4	0
Professional services	7	7	0
Community services	11	11	0
Food stores/restaurants	3	3	0
Land use	6	4	2
Amenities	5	5	0
Physical activity facilities	5	5	0
Aesthetics	7	7	0
Stray animals	1	1	0
Condition of town center	12	10	2
Street types	5	4	1
Intersection signs	3	3	0
Street & intersection features	7	6	1
Speed limits	9	9	0
Street & intersection safety	18	17	1
Modes of transportation	9	9	0
Forms of parking	6	5	1
Bicycle suitability	10	9	1
Sidewalks	13	13	0
People	14	13	1
Types of housing	4	4	0
Residential density	3	2	1
Overall impression	5	5	0
Total	179	168	11

All data collected from July–November 2014 in the rural United States.
[a] Number of items with percent agreement ≥0.75.
[b] Number of items with percent agreement <0.75.

4. Discussion

Residents in rural areas face greater environmental barriers to engaging in physical activity (e.g. long distances to recreational facilities, inadequate walking infrastructure) as compared to their urban counterparts (Thornton et al., 2012). Disadvantages in environmental conditions may in turn contribute to the higher prevalence of physical inactivity among rural populations (Befort et al., 2012; O'Connor and Wellenius, 2012). Due to the unique characteristics of rural landscapes, tailored community audit tools are needed to improve our understanding of rural community features that influence health-related behaviors and inform health promotion interventions in these settings.

The present study outlined the development and testing of an audit tool designed for use in rural communities: iCHART. Unlike previous rural-specific tools that focused solely on individual street segments, the iCHART tool provides a comprehensive and convenient assessment of local physical activity environments. Specifically, it includes key rural built environment features that influence physical activity including town arrangement (dispersed vs. compact), community services, and commuting infrastructure (e.g. bike lanes, sidewalks). Furthermore, the time required to complete the iCHART tool (50 min) is shorter than most other assessment tools, which range from 5 to 20 min per segment, with each community consisting of multiple segments (Brownson et al., 2009).

Conducting field tests with community residents instead of trained researchers is a unique component of this study. Overall, high agreement was observed between our research team member and community testers, and among community testers. This highlights the feasibility of the iCHART as a tool for local residents to assess built environment features. Although high reliability scores may be explained by community testers' familiarity with their environment (Hoehner et al., 2006), the high agreement between our research team member and community testers indicates that subjective bias was minimal. Such high inter-rater reliability also suggests that the iCHART codebook and field testing guide were sufficiently well developed to guide testers without time-intensive, in-person training. Any low agreement items were randomly distributed across different elements in the tool, which further confirms the adequacy of our codebook.

Our study had a broader geographic range than previous studies (Yousefian et al., 2010; Evenson et al., 2009; Fisher et al., 2010; Scanlin et al., 2014) with testing sites in 26 rural towns across five different states. These towns varied in size, demographic composition, and geographic location. This enhances the generalizability of our findings and illustrates the adaptability of our tool across diverse rural settings. In addition, the iCHART tool was developed through a careful iterative process which included an extensive review of existing assessment tools, pilot testing, and consultation with experienced Extension educators.

Although recent research has highlighted 'virtual audits' using Google Street View (publicly available omnidirectional imagery) as a more cost-effective alternative to in-person field audits (Anguelov et al., 2010; Badland et al., 2010; Clarke et al., 2010; Curtis et al., 2010; Odgers et al., 2012; Rundle et al., 2011; Wilson et al., 2012; Bader et al., 2015), they are currently less appropriate for rural settings. As many rural areas are not easily accessible by car, Google Street View images are less complete and often unavailable for rural areas (Clarke et al., 2010). Even if rural images are available, they are often less frequently updated than images from urban areas and may be missing key built environment features (e.g. new grocery store, incomplete sidewalks). However, as Google Street View continues to improve the scope and quality of its imagery, combining the iCHART with this emerging technology would be a valuable direction for future research.

Notwithstanding these strengths, there are ways in which the tool could be strengthened further. Although we used adjusted kappa values to assess intra-rater reliability among community testers, this method was not able to adjust for some items that had almost no variation (i.e. testers almost always indicated these items as "present" or "not present"). One should be cautious in interpreting high adjusted kappa values and high percent agreement among items that were rarely present (e.g. landfill, roundabouts, raised crosswalk). These values only suggest a high degree of agreement between a person's test and re-test responses rather than confirming the absence of rarely present features (Hoehler, 2000).

Several items on the iCHART tool that were subject to temporal instability achieved lower intra-rater agreement (e.g. "people's observed social activities" and "modes of transportation"). Observations of these items often varied according to the time and date of each audit (Cerin et al., 2011). To allow for more reliable estimates, future studies should ensure that duplicate audits are conducted within the same timeframe on the same day of the week.

Although the iCHART tool was designed to objectively assess community features, there were a few items (e.g. "overall impression of the town") that required subjective judgement. This led to a lower agreement between testers, common among other studies (Yousefian et al., 2010; Hoehner et al., 2006; Cerin et al., 2011), suggesting that further refinement of these items in the codebook may be needed. Tester fatigue may also have contributed to the lower agreement. Most subjective questions were placed at the end of the tool when fatigue was highest, making differential assessments more likely.

Another limitation is the absence of measures assessing the quality of community resources and amenities. Although the quality of physical activity facilities (McGuirt et al., 2011; Casey et al., 2008) has been found to influence rural residents' behaviors (Cleland et al., 2015a), it is difficult to capture all environmental factors in a single tool. Additional contextual information could be obtained through other methods, including photos, interviews, and/or focus groups.

Despite these limitations, the iCHART tool serves an important role in identifying the fundamental features and characteristics of rural communities. Recognizing and promoting existing resources could be an effective way to encourage physical activity in rural areas (Seguin et al., 2014; Frost et al., 2010; Cleland et al., 2015a; Cleland et al., 2015b; Olsen, 2013). Future research should focus on combining objective assessments with other methods, such as focus groups with community residents and interviews with service providers. This type of triangulation approach will further enhance our understanding of the contextual factors influencing rural physical activity behaviors to better meet local needs (Hoehner et al., 2006). Future audit tools should also include a scoring system to determine the overall physical activity friendliness of rural towns (Yousefian et al., 2010). Lastly, users of the iCHART are encouraged to adapt the tool to meet their assessment needs.

4.1. Conclusion

The iCHART tool provides a comprehensive and reliable assessment of built environment features that may influence physical activity behaviors in rural settings. Minimal training is required to yield reliable results such that it can be feasibly used by researchers, practitioners, and local residents to enumerate community needs and resources. As rural communities face unique challenges to physical activity, the iCHART serves as an ideal tool to help inform targeted policies, programs, and interventions aimed at improving the health of rural communities.

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Conflicts of interest

Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the authors and do not necessarily reflect the view of the NIH/NHLBI, National Institute of Food and Agriculture (NIFA) or the United States Department of Agriculture (USDA). No financial disclosures were reported by the authors of this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.pmedr.2017.06.008.

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