Assessing the Environment for Support of Youth Physical Activity in Rural Communities

This manuscript is intended for the Research Article Section

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INTRODUCTION

Obesity is a significant health concern in the United States (U.S.). In 2012, more than 1/3 of all U.S. children and adolescents were overweight or obese.¹ The causes of obesity are complex and include a variety of behavioral, social, biological and environmental factors.^{2,3} In the past, obesity prevention strategies centered on education and behavior modification.⁴ Despite the focus on education, individual dietary changes and lifestyle adjustments, the number of overweight and obese individuals in the U.S. continues to rise.⁵ Focusing on early prevention and targeting youth to encourage healthful behaviors is paramount in the prevention of obesity.

Early adolescence is a period marked by physical, mental and emotional growth, and personal maturation. It is a time that presents both challenges and opportunities to the individual, as identities are being formed and a sense of autonomy is being developed.⁶ During the transition from childhood to adolescence and into adulthood, individuals become more independent and begin making decisions that can have a lasting impact on their lives.⁷ Therefore, adolescence is not just a period of substantial physical growth, but a period in which an individual has the power to make important decisions and control some of their health outcomes.

There is a growing consensus among researchers that the physical environment plays a significant role in influencing an individual's dietary choices and physical activity behaviors.^{2,3,8-}

¹⁶ The built environment is a multidimensional concept that encompasses 1) "urban design" or the design of the city and the different elements within it, 2) "land use," or the way in which the land is used for residential, commercial, office, and industrial activities, and 3) "transportation systems," which includes the roads, sidewalks, bike paths, and other avenues utilized for transportation.¹⁷

Even though obesity is considered a complex, multifactorial disease, inadequate physical activity and poor nutrition have long been identified as critical factors in its development.^{3,18,19} According to Maley et al., physical environments that encourage sedentary lifestyles and the consumption of calorically dense foods are major contributors to the obesity epidemic.¹⁶ When observing the nation's obesity problem in the context of the physical environment, one can begin to understand why past intervention strategies had only modest long-term success. Educating the general public about proper nutrition and the importance of an active lifestyle is of little worth when the physical environment prevents them from putting that information into action.^{10,20} Understanding the link between the built environment and the physical activity choices that people make is a crucial step in the fight against obesity.

Despite the significant role the environment plays in influencing behavior,^{3,8,21} and the limited success of individual-based interventions on long-term obesity prevention,²² protocols for assessing the built environment are still relatively new.^{23,24} Gasevic et al. believe environmental audit tools are necessary to enhance built environment knowledge and to identify environmental features that may be linked to obesity and other obesogenic behaviors.²⁵ Several tools are available to assess the food and physical activity environments in a community. Unfortunately, most of these tools are targeted towards urban community structure and urban city design. There are significant differences between urban and rural communities in terms of natural landscape, societal culture and norms, transportation infrastructure, and built environment design. Therefore, the findings from urban studies may not be applicable as a basis for rural community intervention strategies.

The lack of assessment tools and targeted interventions for rural communities is concerning, especially since rural U.S. residents, when compared to urban residents, experience a

higher prevalence of physical inactivity and obesity.²⁶ To make matters worse, when compared to their urban peers, rural children are approximately 25% more likely to be overweight.²⁷ Rural areas face unique challenges in addressing the obesity epidemic. A lack of exercise facilities and sidewalks, safe walking and play areas, and limited access to healthy foods, may be potential challenges rural communities face.

While previous studies have linked obesity prevalence with objective neighborhood measures, there is a gap in the literature in correlating environmental assessment data, environmental perceptions, and weight status.²⁸⁻³⁰ Powell-Wiley et al. have linked unfavorable perceptions of the physical environment with increased obesity.²⁸ Despite this association, it remains unclear whether the perceptions of individuals in rural communities match the objective measures of the corresponding built environment. Therefore, the purpose of this study is twofold: 1) to assess environmental support of physical activity in rural areas and 2) to determine whether there is a correlation between the measured environment for physical activity and the physical activity perceptions of the 6th to 8th grade youth in these rural communities.

METHODS

Study Design

This study was conducted as a part of a larger, 5 year, tri-state, Community-Based Participatory Research (CBPR) project entitled “Ignite: Sparking Youth to Create Healthy Communities.” While the Ignite project targets both urban and rural communities in South

Dakota (SD), Kansas (KS), and Ohio (OH), the study described in this paper focuses only on the rural study communities within SD and KS. Institutional Review Board (IRB) approval, subject assent, and parental consent was obtained in accordance with the policy statements of the Human Subjects Committees at South Dakota State University (SDSU) and Kansas State University (KSU).

Communities and Participants

Communities were chosen based upon the following protocol. Cooperative Extension services in SD and KS developed and distributed a request for proposals to communities within each state. Those interested in participating in the project submitted an application for funding to their corresponding Extension office; for consideration, communities needed to meet “low-income” and/or “minority” definitions which were established by the research team.

A community fulfilled the “low-income” qualification if one of the following conditions was met: county/community poverty level was higher than the state average, county/community household income average was below 185% federal poverty level, county/community percentage of those who qualify for free or reduced-priced school lunches was higher than the state average, or the majority (51 percent and above) of county/community residents qualified for free or reduced-priced school lunches. “Minority” definitions were met if the county/community had higher than the state average of non-Caucasian residents or the majority (51 percent and above) of the county/community consisted of non-Caucasian residents. Sixth through 8th grade youth from schools within each community were recruited through classroom teachers and school

administrators. Parental consent and child assent were received prior to the youth's participation in the study.

Environmental Assessments

Environmental assessments were conducted by study personnel. To ensure accuracy and consistency between states, all researchers were trained prior to conducting assessments. The built environment in each of the 4 rural communities was audited using both the Active Neighborhood Checklist (ANC)³¹ and the Physical Activity Resource Assessment (PARA).³² At the time of the study there were no tools specifically designed to measure rural and frontier environments. The ANC and PARA were selected because they each measure different aspects of the physical environment and together provide a more comprehensive assessment of the overall physical environment.

The Active Neighborhood Checklist (ANC)³¹ is a reliable, direct-observation audit tool that looks at features of the neighborhood environment and their relation to physical activity behaviors. The ANC assesses 5 different areas within the community: land use, public transportation, local street characteristics, quality of the environment for a pedestrian, and places to walk and bicycle. Hoehner et al. measured interrater reliability for land use characteristics, street characteristics, quality of the environment for a pedestrian, sidewalks, shoulders, and bike lanes using both observed agreement and the kappa statistic.³¹ The mean observed agreement for 57 evaluated items was 0.87 with a range of 0.61-1.00, and the mean kappa statistic was 0.68 with a range of 0.21-1.00.³¹ Total ANC scores range from 0 to 59 and were calculated by combining sub-scores from land use, public transportation, street characteristics, quality of the

environment, and places to walk or bicycle. A score of 0 represents the least friendly environment for being physically active, while a score of 59 represents the friendliest environment for engaging in physical activity.

Areas for audit were chosen per instructions in the Active Neighborhood Checklist – Protocol, Version 2.0.³¹ The areas assessed centered around the schools in the selected communities. Routes/street-segments within the defined areas were chosen based on input from steering committee members and the local Extension agent to ensure a representative number of streets were captured by the audit. Ten street-segments in SD Community I, 19 in SD Community II, 5 in KS Community I and 3 in KS Community II were assessed.

The Physical Activity Resource Assessment (PARA) is a 1 page observation tool designed by Lee et al.³² to assess the physical activity resources within a community. In the development of the PARA tool, Lee et al. reported that reliability tests of items with $\geq 10\%$ agreement showed $r > 0.77$.³² Locations assessed by the PARA included schools, parks, churches, community centers, fitness centers, indoor and outdoor athletic facilities, walking and bicycling paths, and local trails. The PARA scores physical activity resources based on their type, location, cost, and quality. Points are assigned based on the presence of certain features such as baseball or soccer fields, basketball courts, and play equipment, amenities such as landscaping, benches, and lighting, and whether or not incivilities like graffiti and trash are present. All features, amenities, and incivilities receive scores ranging from 0 to 3, with 0 = not present, 1 = poor, 2 = mediocre, and 3 = good.³² Total PARA scores range from 0 to 75 and are calculated by summing the features and amenities scores and subtracting the incivilities scores. Higher scores are indicative of resources with a greater number of features and amenities, while lower scores are desirable for incivilities.

Using the PARA tool, trained researchers from SDSU and KSU assessed 29 physical activity resources (i.e. basketball courts, swimming pools, soccer fields, play equipment, etc.) that were available to the general public. Nine physical activity resources were audited in SD Community I and 14 in SD Community II. In KS, 2 resources were assessed in KS Community I and 4 in KS Community II. For each physical activity resource, total PARA and sub-scores for features, amenities, and incivilities were calculated.

Assessment of Behavior and Perception

Youth (6th to 8th grade) perception of the local physical activity environment was assessed using 5 questions adapted from previously validated tools.^{33,34} Prior to use, questions were cognitively tested for content, organization, and comprehension with non-study participant youth in 6th to 8th grade. The final questions were administered to assenting students in 6th to 8th grade in the 4 communities in SD and KS. The survey questions queried on how much participants agree with the following statements: 1) I think there are plenty of opportunities to be physically active in my community; 2) It is difficult to be physically active in the local park/street near my home because there is not enough space to be active in; 3) It is difficult to be physically active in the local park/street near my home because there are no choices for activities; 4) It is difficult to be physically active in the local park/street near my home because there is no equipment/facility; 5) It is difficult to be physically active in the local park/street near my home because it is not safe (due to crime or traffic). Using a Likert scale, possible responses ranged from “not at all agree,” to “strongly agree,” with 1 being “not at all agree,” to 5 being “strongly agree.” Each individual question was scored and a Total Perception of the Environment (TPE) score was computed by

reverse-coding questions 2, 3, 4, and 5, summing the scores from all questions, and then dividing by 5. Cronbach's alpha for the TPE score was 0.63.

The proportion of students being physically active for 60 or more minutes most days of the week was assessed by asking each student the following question (adapted from Youth Risk Behavior Survey³⁵ and the Active Living Research Adolescent Survey 1³⁴): "Over a typical or usual week, how many days did you do moderate to vigorous physical activity like brisk walking, dancing, aerobics, running, swimming, or competitive games (e.g. football, volleyball, basketball) for a TOTAL of at least 60 minutes per day?" Possible responses were 0 days to 7 days. Responses were dichotomized into not being physically active on most days (0 to 3) or being physically active on most days (4 to 7).

Analyses

A one-way analysis of variance (ANOVA) and post-hoc analysis with Bonferroni's Adjustment were used to determine differences among the 4 communities in ANC total and sub-scores, PARA total and sub-scores, and perception of the environment scores. ANC and PARA scores were each transformed to a scale of 5 prior to correlating with TPE scores. Total ANC scores were scaled by dividing final scores by 59 and multiplying by 5 and Total PARA scores were scaled by dividing final scores by 75 and multiplying by 5. Scaled ANC, scaled PARA, and Perception of the Environment scores ranged from 0 to 5. Pearson's correlations were computed to assess the relationship between 1) TPE score and scaled Total ANC score, and 2) TPE score and scaled Total PARA score. All analyses were completed using SPSS version 22.0 (IBM

Corp., Armonk, NY, 2013). Significance was set at ≤ 0.05 for ANOVA and 0.0125 for Bonferroni's Adjustment.

RESULTS

Total ANC scores ranged from 16.6 (SD=7.1) to 23.0 (SD=2.0) (Table 1). There were no differences among communities in Total ANC Scores, or sub-scores of Land Use, Public Transportation, Quality of the Environment, or Places to Walk or Bicycle ($p \leq 0.05$). However, there was a difference in Average Street Characteristics among the 4 communities. KS Community II had a higher Street Characteristics score than the other 3 communities, which is indicative of a community better equipped to support walking and biking. There were no differences among the communities in the Total PARA and any of the PARA subscores (Table 1).

Three hundred fifteen participants (average age 13.0 ± 1.0) out of a possible 837 completed the perception survey questions with 45% of respondents being male and 55% of respondents being female. Fifty one percent of survey respondents were Hispanic, Latino, or Spanish, 27% were Caucasian, and 10% were American Indian or Alaskan Native. There were no differences among communities in participants' perception of opportunities for physical activity (Question 1), availability of equipment/facilities for being physically active (Question 4), and perception of crime and traffic safety concerns (Question 5) (Table 2). SD Community II was significantly different from the other 3 communities in perceiving lack of space for physical activity (Question 2) and having too few choices for physical activity (Question 3). Total perception of the environment scores range from 3.8 to 4.5 out of a possible 5 indicating that students perceive the environment as supporting physical activity. When asked if the

environment offered plenty of opportunities to be physically active, a majority (greater than 50%) of students responded with “moderately agree” or “strongly agree.” When asked if it was difficult to be active in the local park/street near their home because 1) there is not enough space to be active in, 2) there are no choices for activities, 3) there is no equipment/facility, and 4) it is not safe, most students responded “not at all agree” or “slightly agree.”

In KS Community I (n=115), KS Community II (n=142), and SD Community I (n=19), the percentage of 6th to 8th grade students who were categorized as being physically active for at least 60 minutes most days were 79%, 78%, and 74%, respectively. SD Community II (n=39) had the lowest percentage of students categorized as physically active, with 61.5% of survey respondents meeting the study-defined criteria of 60 minutes of moderate-to-vigorous physical activity most days. There were no significant differences among communities in reported participant physical activity levels.

There was a weak positive correlation between TPE scores and Total ANC scores ($R^2=0.016$, $p=0.026$). TPE scores were not correlated with Total PARA scores ($R^2=0.012$, $p=0.056$).

DISCUSSION

Obesity prevalence and objective neighborhood measures have been correlated in the past, but few investigators have examined the link between the measured physical environment and individual environmental perceptions.²⁸⁻³⁰ In this study, objectively assessed rural built environment data from SD and KS were compared with the environmental perceptions of 6th to 8th grade students within each respective community. All 4 communities scored near or less than

the median in both Total ANC and Total PARA. Based on these results, one might assume the rural environments offer little in terms of physical activity resources. This finding is consistent with that reported by the Active Living Research that rural communities often lack sufficient resources to support physical activity.³⁶

Despite the objective findings that the rural environment lacks support for physical activity, the students' perception of the environment for physical activity, as seen in Table 2, was positive. Even though Total ANC and TPE scores were significantly correlated, the association was weak. Furthermore, the Total PARA and TPE scores were not correlated. This weak correlation and lack of significance suggests the objective environmental assessments conducted in these communities may not accurately represent or reflect local environmental perception. This lack of correlation between the measured and perceived environment for physical activity is in contrast to that reported in a review by Nasar.³⁷ Nasar posits that "people, regardless of their socio-cultural characteristics, generally have similar perceptions of the aesthetics of an environment. Moreover, these perceptions are not just 'in the eye of the beholder,' but rather are linked to characteristics of the environment."³⁷ One possible explanation for the lack of concordance between the measured and perceived environment in this study could be due to the tools used to measure the rural environment. The PARA and the ANC, which have traditionally been used in urban environments, may have failed to adequately capture all physical activity components of the rural environment.

Reported physical activity levels seem to align with the student perceptions as opposed to the built environment scores. SD Community II had the lowest percentage of students engaging in moderate-to-vigorous physical activity for 60 or more minutes most days of the week, and also had students report the lowest TPE score. KS Community I, KS Community II, and SD

Community I reported higher percentages of students engaging in moderate-to-vigorous physical activity most days of the week, as well as higher TPE scores. These findings suggest that perception of the environment may directly influence levels of physical activity. There is evidence, although limited, that has linked poor environmental perception with reduced levels of physical activity.³⁸

The social-ecological model (SEM) is a conceptual framework that has been used to better understand the complex relationship between social influences, environmental impacts, local policies, and active living.³⁹ Within the social-ecological framework, McLeroy and associates have stated that health behaviors are influenced by intrapersonal (knowledge and beliefs), interpersonal (relationships with families, friends, etc.), organizational, community, and policy factors, and that health promoting interventions need to be directed toward each of these components.⁴⁰ Lytle posits that the most promising approach to health promotion is one that focuses on, and understands, the complex interplay between urban planning, sociological, psychological, biological, policy and transportation systems.⁴¹ The results from this study in rural environments are in concordance with Lytle's recommendations, demonstrating that findings from the local physical environment need to be taken into consideration with individual perception of that environment. Communities included in the study were ethnically diverse and consisted of a high proportion of Hispanic, Latino, Spanish, and Native American individuals. By gaining access to these communities, study results provide a unique perspective on individual environmental perception and allude to the necessity of exploring what the target population, in this case the youth, see as important resources to support physical activity.

Although the present study adds a new rural perspective to current literature, there are limitations that need to be acknowledged. Surveys were distributed to 6th to 8th grade youth, so

the perceptions of students in elementary school (Kindergarten to 5th grade) and high school (9th to 12th grade) were not considered and may differ from the students in this study. A 2nd limitation stems from the built environment assessment tools used. Although, at the time of the study, the PARA and ANC were the best tools available to assess the communities, they were not originally designed for rural communities and environments. The Cronbach's alpha for the TPE score, although in a favorable range, could have been stronger.

IMPLICATIONS FOR RESEARCH AND PRACTICE

It is important for nutrition educators to incorporate environmental change in their programming for maximum impact.⁴² This study provides insight into the environment of rural communities and offers support for the development of more effective approaches and/or comprehensive approaches for measuring physical activity environments and programming. The results of this study demonstrate perception may not always match built environment assessment data. While several tools have been developed to objectively measure the built environment, differences between urban and rural environments have prevented the creation of a universal assessment tool. Without a standardized tool, making comparisons across settings and between studies is quite difficult.^{25,32} When assessing physical activity levels and determining which environmental components impact individual behaviors, a more comprehensive approach may be needed. Future studies should focus on refining and improving existing environmental audit tools and developing new, comprehensive, location-specific tools.

The findings from this study indicate when working on health and wellness programming, researchers should determine what the youth (or any target population) view as physical activity resources. Individual perception may play a key role in physical activity behaviors; if the environment is perceived in a positive manner, children and community members may be more likely to utilize local resources that are already available. Therefore, finding ways to capitalize on youth perception may be a useful strategy for increasing physical activity, even if the overall measured environment does not appear conducive to physical activity. Better tools are needed to measure physical activity environments in rural areas, and alternative opportunities for physical activity may need to be included in the measurements to provide a total picture of activity support.

Why are rural specific tools needed? An outsider assessing the environment may not recognize all resources utilized by students and community members. For example, even though a community may lack basketball courts or baseball fields, one must not forget that children and adolescents are innovative and creative, and therefore, it is possible that other areas such as driveways, streets, and yards are used for these activities. In the development of these tools, researchers should consider ways of measuring unique areas for physical activity (i.e. farmlands and fields), and incorporating ways to capture cultural components of physical activity, as well as individual perception.

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Objective: Assess environmental support of physical activity (PA) in rural areas and determine whether there is a correlation between the measured environment for PA and the participant perceptions of the environment for PA.

Design: The PA environment was assessed using the Active Neighborhood Checklist (ANC) and the Physical Activity Resource Assessment (PARA). Youth behavior and perceptions related to PA and the local environment were assessed using 5 questions from previously validated tools.

Setting: Four rural low-income communities in South Dakota and Kansas.

Participants: 6th – 8th grade youth.

Variables Measured: PARA, ANC, behavior, and perception.

Analysis: A one-way analysis of variance (ANOVA) was used to determine if there were differences in ANC, PARA, and Perception of the Environment scores among communities. Pearson's correlations were used to assess associations between ANC and student perception of the environment and PARA and student perception of the environment.

Results: There were no differences in Total ANC or Total PARA among the communities. Perception was weakly correlated with Total ANC ($R^2=0.016$, $p=0.026$, $n=308$) but not Total PARA.

Conclusions and Implications: PA perception in rural communities may not match objective measures. Future research should work toward refining and improving existing environmental audit tools and developing new, comprehensive, location-specific tools.

Key Words: Physical Activity; Perception; Adolescent; Obesity; Environment; Built Environment; Rural; Rural Population

(218 words)

Table 1: Environmental Audits for Local Physical Activity Resources in Rural Areas

Active Neighborhood Checklist (ANC) Scores ^{1,2}				
Community ³	Kansas I (n=5)	Kansas II (n=3)	South Dakota I (n=10)	South Dakota II (n=19)
Land Use (Public Recreational Facilities and Equipment) ⁴	0.2±0.4	1.3±1.2	1.3±1.5	1.4±1.3
Public Transportation ⁵	0.0±0.0	0.0±0.0	0.0±0.0	0.1±0.5
Street Characteristics ⁶	2.0±0.7 ^a	4.7±0.6 ^b	1.9±0.7 ^a	2.0±1.2 ^a
Quality of the Environment ⁷	6.4±0.9	7.0±0.0	6.8±1.0	6.6±0.8
Places to Walk or Bicycle ⁸	8.0±5.7	10.0±1.0	12.1±7.2	9.3±6.3
Total ANC ⁹	16.6±7.1	23.0±2.0	22.1±7.6	19.4±7.1
Average Physical Activity Resource Assessment (PARA) Scores ^{10,11}				
Community ³	Kansas I (n=2)	Kansas II (n=4)	South Dakota I (n=9)	South Dakota II (n=14)
Features ¹²	16.0±0.0	15.8±9.1	7.7±3.6	9.8±5.5
Amenities ¹³	19.5±2.1	23.0±5.4	18.6±7.1	18.8±8.4
Incivilities ¹⁴	1.0±1.4	0.5±0.6	0.9±1.3	2.3±2.0
Total PARA ¹⁵	34.5±3.5	38.3±12.8	25.3±8.2	26.3±11.7

⁽¹⁾ Differences determined with one-way analysis of variance and post-hoc analysis with Bonferroni's Adjustment. Scores with a different alphabetical superscript are significantly different at $p \leq 0.05$.

⁽²⁾ Higher scores are better for sub-scores and Total ANC

⁽³⁾ Community location and number of routes/segments or activity resources assessed.

Sub-scores range from: ⁽⁴⁾0-6; ⁽⁵⁾0-4; ⁽⁶⁾0-7; ⁽⁷⁾0-12; ⁽⁸⁾0-30

⁽⁹⁾ Total ANC Score = Land Use + Public Transportation + Street Characteristics + Quality of the Environment + Places to Walk or Bicycle. Scores range from 0-59

⁽¹⁰⁾ Differences determined with one-way analysis of variance and post-hoc analysis with Bonferroni's Adjustment. No significant differences were found between the four communities at $p \leq 0.05$

⁽¹¹⁾ For features and amenities, higher scores are better. For incivilities, lower scores are better.

Sub-scores range from: ⁽¹²⁾0-39; ^(13,14)0-36

⁽¹⁵⁾ Total PARA = Features + Amenities - Incivilities. Scores range from 0-75 with higher scores being better.

Table 2: Rural Youth Perception of the Environmental Support for Physical Activity¹

Community ²	Kansas I (n=115)	Kansas II (n=142)	South Dakota I (n=19)	South Dakota II (n=39)
Q1: I think there are plenty of opportunities to be physically active in my community ³	3.7±1.3	3.9±1.2	4.0±1.1	3.6±1.4
Q2: It is difficult to be physically active in the local park/street near my home because there is not enough space to be active in ³	1.6±1.1 ^a	1.6±1.1 ^a	1.2±0.5 ^a	2.2±1.4 ^b
Q3: It is difficult to be physically active in the local park/street near my home because there are no choices for activities ³	1.8±1.2 ^{a,b}	1.6±1.0 ^a	1.4±0.7 ^{a,b}	2.2±1.4 ^b
Q4: It is difficult to be physically active in the local park/street near my home because there is no equipment/facility ³	2.0±1.3	1.7±1.1	1.4±0.7	2.0±1.3
Q5: It is difficult to be physically active in the local park/street near my home because it is not safe (due to crime or traffic) ³	1.8±1.2 ^{a,b}	1.6±1.2 ^a	1.4±0.6 ^{a,b}	2.3±1.5 ^b
TPE for Physical Activity ⁴	4.1±0.7 ^a	4.3±0.7 ^a	4.5±0.5 ^{ab}	3.8±0.9 ^b

⁽¹⁾ Differences determined with one-way analysis of variance and post-hoc analysis with Bonferroni's Adjustment. Scores with a different alphabetical superscript are significantly different at $p \leq 0.05$.

⁽²⁾ Location and number of students who completed surveys.

⁽³⁾ Students were asked: "How much do you agree with the following statement?" Possible responses include 1=not at all agree, 2=slightly agree, 3=somewhat agree, 4=moderately agree and 5=strongly agree. Higher scores indicate greater agreement.

⁽⁴⁾ Total Perception of Environment for Physical Activity Score. Environmental perception questions 2-5 were reverse scored so that 1=5, 2=4, and 3=3. Questions 1-5 were totaled and averaged.