

## Adaptation and reliability of neighborhood environment walkability scale (NEWS) for Iran: A questionnaire for assessing environmental correlates of physical activity

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### Abstract

**Background:** In spite of the increased range of inactivity and obesity among Iranian adults, insufficient research has been done on environmental factors influencing physical activity. As a result adapting a subjective (self-report) measurement tool for assessment of physical environment in Iran is critical. Accordingly, in this study Neighborhood Environment Walkability Scale (NEWS) was adapted for Iran and also its reliability was evaluated.

**Methods:** This study was conducted using a systematic adaptation method consisting of 3 steps: translate-back translation procedures, revision by a multidisciplinary panel of local experts and a cognitive study. Then NEWS-Iran was completed among adults aged 18 to 65 years (N=19) with an interval of 15 days. Intra-Class Coefficient (ICC) was used to evaluate the reliability of the adapted questionnaire.

**Results:** NEWS-Iran is an adapted version of NEWS-A (abbreviated) and in the adaptation process five items were added from other versions of NEWS, two subscales were significantly modified for a shorter and more effective questionnaire, and five new items were added about climate factors and site-specific uses. NEWS-Iran showed almost perfect reliability (ICCs: more than 0.8) for all subscales, with items having moderate to almost perfect reliability scores (ICCs: 0.56-0.96).

**Conclusion:** This study introduced NEWS-Iran, which is a reliable version of NEWS for measuring environmental perceptions related to physical activity behavior adapted for Iran. It is the first adapted version of NEWS which demonstrates a systematic adaptation process used by earlier studies. It can be used for other developing countries with similar environmental, social and cultural context.

**Keywords:** Environment, Physical activity, Neighborhood Environment Walkability Scale, Psychometrics, Iran.

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### Introduction

Lack of physical activity and sedentary lifestyle is common among Iranian adults. According to the latest statistics, more than 30% of the Iranian adult populations are insufficiently active (1). Also, a research reviewing 3 national surveys during 1999 to 2002 shows that the population's sedentary lifestyle is becoming a public health problem, with 70-80% being physically inactive (2). Until the last two decades, physical activity research focused on individual and social factors particularly in medicine

and public health. Only recently the focus has been switched to the links between the built environment and physical activity. The research field has seen rapid growth in many developed countries such as the USA, Australia and also European countries; but it is still in infancy period in many developing countries like Iran.

One of the challenges specific to this new research domain is measuring the attributes of the built environment associated with physical activity in a valid, reliable and feasible way (3). Studies in this field of re-

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search have typically used two types of measures for assessing the built environment:

1. Objective measures of the environment derived from scientific observations of the environment using audits or GIS data
2. Subjective measures of the environment using questionnaires to understand residents' perceptions of the built environment (4).

There are several questionnaires that attempt to assess the perceptions of the built environment for adults' physical activity (5-7) among them is the Neighborhood Environment Walkability Scale (NEWS) which was developed in the United States (8) and has been widely used in other countries (9-11). Furthermore, International Physical Activity and Environment Network (IPEN) uses NEWS for cross country analysis of the built environment and physical activity relationships (12). This tool has been tested for its validity and reliability (repeatability) and has been translated into many languages such as Chinese (13), Japanese (14), German and Nigerian (15).

However, applicability of NEWS to the research performed in other countries may be limited due to the differences in culture and environmental characteristics (15). For example many urban environments in developing countries differ from their counterparts in developed ones. Some of these differences are neighborhood structure, land terrains, land use, infrastructure, transportation modes, but the most important one is the diversity of cultural and social norms in the use of open spaces and doing physical activity in urban environments.

The purpose of this study is to systematically adapt the abbreviated version of the NEWS questionnaire to Iran and evaluate its test-retest reliability among adults aged 18-65 years.

## Methods

### Data

For adaptation process, data were gathered via independent interviews with a multidisciplinary panel of six local experts in-

cluding public health, urban design, transportation and urban planning disciplines. For cognitive testing (pilot study) five adults with different educational levels and from different social classes (16) aged from 25 to 60 years were chosen.

Reliability testing was conducted with a sample of adults (N=19) aged between 24 and 30 including postgraduate students in the faculty of architecture and planning. The inclusion criteria were: 1- Living in an urban area, 2- Being an adult (18-65 years old), 3- Being generally healthy, and 4- Not having any disabilities that prevent the person from physical activities such as walking. The participants completed the modified questionnaire twice with an average interval of 15 days.

### Instrument

NEWS<sup>1</sup> (also called San Diego instrument) is a 98-question instrument developed by Sallis and colleagues to determine the perception of neighborhood design features hypothesized to be related to physical activity (8,17). "The NEWS was designed to obtain residents' perceptions of how neighborhood characteristics found in the transportation and urban planning literature was related to a higher frequency of walking and cycling trips" (18). Additional NEWS items were created based on the input from local planning and transportation experts. NEWS questionnaire has an abbreviated version with 54 items which enables effective research. The abbreviated questionnaire (NEWS-A) is better suited to the fast-paced life of metropolitan areas such as Tehran.

The questionnaire assessed several environmental characteristics as follows (8):

- 1) Residential density
- 2) Land use Mix-Diversity: Proximity to non-residential land uses such as restaurants, retail stores and shopping centers
- 3) Land use Mix-Access: Ease of access to non-residential uses

<sup>1</sup>. The original NEWS questionnaire and its abbreviated version are available at [www.drjamesallis.sdsu.edu](http://www.drjamesallis.sdsu.edu).

- 4) Street connectivity
- 5) Walking/cycling facilities such as sidewalks and pedestrian/cycling trails
- 6) Aesthetics
- 7) Pedestrian traffic safety
- 8) Crime Safety

With the exception of the residential density and land use mix–diversity subscales, all items had a numerical Likert scale from 1 (strongly disagree) to 4 (strongly agree), with higher scores indicating a more favorable value of the environmental characteristics. Subscale scores were calculated as the mean across the items. Residential density items ask about the frequency of various types of neighborhood residences, from single-family detached homes to 13-story or higher apartments. These items had a numerical range starting from 1 (none) to 5 (all). “Land use Mix-Diversity” is assessed by the walking proximity from a person’s residence to various types of stores and facilities. The answers to these items range from 1- to 5-minute walking distance (coded as 5) to  $\geq 30$ -minute walking distance (coded as 1). Higher scores on this subscale indicate closer average proximity (8).

Items of the NEWS questionnaire are shown in Table 1.

### *Adaptation process*

In this study NEWS was adapted for Iran using a systematic process recommended by IPEN experts that had 3 stages as follows (19):

#### 1. Translation/back-translation

The translation of the questionnaire was done by an expert fluent in both Farsi and English. The research team verified the quality of the translation through independent reviews. Any translation problem(s) were discussed until a final consensus was reached.

#### 2. Revision by a multidisciplinary panel of local experts

A multidisciplinary panel of local experts was recognized to use their feedbacks and comments about core and added items reflecting the local environment, discussing following questions as recommended by

IPEN (19):

– "How can we clearly communicate the meaning of the current items (in the questionnaire)?"

– "What other environmental barriers to physical activity are important (in Iran)?"

– "What other environmental facilitators to physical activity are important (in Iran)?"

– "Are there any special circumstances or variations by region that need to be included in the measure?"

Results of the interviews were some new items that were chosen as candidates to be added to the questionnaire.

#### 3. Cognitive testing (pilot study)

A pilot study on the modified questionnaire was conducted with the help of five adults who were asked about their understanding and clarity of the items and also any suggestions for improvement. They were also asked if any specific items were missing or if any questions made them uncomfortable. The results from these interviews were discussed with the research team and some items were rephrased. Also, the format and appearance of the questionnaire was discussed and improved.

### *Statistical analysis*

Test-retest reliability of the adapted NEWS (NEWS-Iran) was chosen for the instrument reliability and for statistical analysis, the one-way model single measure intra-class correlation coefficient (ICC) was used. This test was done on each item of the questionnaire as well as the subscales which computes the coefficient of stability of the scores on the two tests.

As a rough guide, the ratings suggested by Landis and Koch (20) on agreement level were followed as the criteria for reliability interpretation. The ratings are as follows:

- 0.0 to 0.2: Poor agreement
- 0.2 to 0.4: Fair agreement
- 0.4 to 0.6: Moderate agreement
- 0.6 to 0.8: Substantial agreement
- 0.8 to 1.0: Almost perfect agreement.

This criterion was used in other similar papers to evaluate the reliability of the questionnaires related to physical activity and the built environment (17,21,22). All the analyses were performed using the SPSS software.

## Results

### *Questionnaire adaptation process*

The experts who participated in the adaptation process suggested some additional items that focused on the influence of harsh weather (wind, rain or snow) on the physical activity. As a result, items related to cycling were removed from the questionnaire because the main physical activity in urban areas of Iran is mainly walking. This reduced the length and complexity of the questionnaire to better suit the fast-paced lifestyle in the urban areas. Another suggestion was the modification of the wordings of some items in the modified NEWS to normalize it for Iran.

After contacting IPEN experts, especially Dr. J. Sallis; the research team was made aware of the NEWS-Nigeria which is localized for Nigeria. Two items were adapted from NEWS-Nigeria and added to the modified questionnaire, one to the “walking facilities” subscale and the other to the “Land use Mix-Access” subscale. For pilot test (cognitive testing) five volunteers participated aged between 36 and 64 years old. According to their views the questionnaire appearance did not clearly convey the purpose of the questionnaire.

Finally different parts of the questionnaire were modified as follows:

- “Residential density” subscale (the first section of the questionnaire) which introduces different types of housing was reported as being vague so examples of each type of housing were added to the questionnaire along with picture.
- The “Land use mix-Diversity” (second section of the questionnaire) was lengthy and confusing for the participants. As a result, the European version of NEWS named ALPHA was used to categorize to shrink 23 individual items into 13 types of uses.

- Two items were not expressed clearly. These items were re-written.

- Two new items including barriers to walking and physical activity were added to the questionnaire: Bad weather conditions and air pollution/quality which was mentioned in other studies too (20). Subsequently, a new subscale was added to the questionnaire as “Air Quality” and was calculated as mean of the mentioned 2 items as well as the item “high exhaust fumes from motor vehicles” from “Pedestrian Safety” subscale.

- Both volunteers and experts suggested adding an item related to encouragement by social circles to engage in physical activities such as walking. Thus, the item “seeing and speaking with others while walking” was added from completed version of NEWS to the adapted questionnaire.

Table 1 shows the adapted NEWS, all items that were added or changed in the adapted questionnaire are explained.

### *Reliability*

The test-retest reliability scores of the adapted questionnaire are reported in Table 1. ICCs of the subscales ranged from 0.82 to 0.92 showing almost perfect reliability. ICC scores of the individual items of the adapted questionnaire ranged from 0.52 to 0.96 showing moderate to almost perfect reliability.

The lowest reliability score (0.56) was “walking proximity to local services like bank/ laundry” and the highest one was related to “Residential Density” subscale (1-3 row houses) with 0.96 ICC score. Two items (indicated in Table 1 by #) showed no reliability due to the lack of variability.

The reliability of the “Residential Density” subscale was 0.92, which is the highest of all. Its items ranged from 0.64 to 0.96. Both “Land use Mix-Diversity” and “Air Quality” subscales scores were 0.91 with items ranging from 0.56 to 0.90 for the first subscale and 0.76 to 0.89 for the second subscale. “Land use Mix-Access” subscale had the lowest reliability score (0.82), range of scores for the items in this

Table 1. Adaptation and test-retest reliability coefficients for individual items and subscales of the NEWS-Iran

Subscale	Item	Adaptation changes	Test-retest reliability
Residential Density		Indicative illustrations/ pictures were added	0.92
	Detached single-family houses		0.88
	1-3 story row houses		0.96
	1-3 story apartments		0.63
	4-6 story apartments		0.86
	7-12 story apartments		0.66
Land use Mix-Diversity	13+ story apartments		0.91
		Categorized into 13 categories of uses	0.91
	Walking proximity to “Local shops” such as:		--- #
	1- Supermarket/Grocery Store		
	2- Bakery/Butchery	Site-specific uses added	0.67
	3- Greengrocery Store (Fruit/Vegetable Market)	Site-specific uses added	0.69
	4- Walking proximity to “Local Services” such as: Bank/ATM, Laundry, Barbershops/Beauty Salons		0.56
	5- Walking proximity to “Educational facilities” such as: Elementary school, High School		0.75
	6- Walking proximity to “Religious and Cultural facilities” such as: Mosque, religious centers, or Library, community center	Site-specific uses added	0.90
	7- Walking proximity to “Medical and Health Services” such as: Pharmacy/Clinic		--- #
	8- Walking proximity to “Local Retail Stores” such as: Clothing, Hardware, Electrical Appliances, Computer equipment, and etc.		0.70
	9- Walking proximity to “Sports Facilities” such as: Swimming Pool, Health Club, or Gym		0.80
	10- Walking proximity to “Public Open Spaces” such as: Parks		0.81
11- Walking proximity to ‘Fast Food/Coffee Shop’		0.80	
12- Walking proximity to “Taxicab / Bus Stop”		0.89	
13- Walking proximity to “Restaurants (Non Fast Food)”		0.80	
Land use Mix-Access			0.82
	Stores are within walking distance		0.56
	Parking is difficult in local shopping areas		0.88
	Many places within walking distance		0.75
	Easy to walk to transit stop		0.60
	Streets are hilly(steep)		0.78
	There are highways/canyons/hillsides that limit routes		0.66
Bad roads/poor drainage	Item added from NEWS-Nigeria	0.84	
Street connectivity			0.90
	Not many cul-de-sacs		0.75
	Short distance between intersections		0.89
walking facilities	Many alternate routes		0.87
	Sidewalks on most streets		0.86
	Sidewalks separated from road/traffic by parked cars	Item omitted(considered as not relevant) by experts and cognitive testing	0.83
	Sidewalks separated from streets by grass/dirt strip		0.54
	Sidewalks are well maintained	Item added from NEWS original	0.69
Sidewalks not obstructed	Item added from NEWS-Nigeria	0.85	

subscale was from 0.56 to 0.88. Following that “Pedestrian Safety” subscale had the score of 0.83 with items ranging from 0.57 to 0.77 ICCs.

Table 1. Cntd

Aesthetics			0.88
	Trees along the streets		0.81
	Interesting things to look at while walking	Item omitted (considered as not relevant) by experts and cognitive testing	
	Attractive natural sights in the neighborhood		0.60
	Attractive buildings/houses in the neighborhood		0.76
	Neighborhood free from litter	Item added from NEWS original	0.87
Air quality			0.91
	Bad weather conditions, such as wind, rain or hot/cold weather as a barrier to walking and physical activity in the neighborhood	Item added by experts and cognitive testing	0.83
	Air pollution as a barrier to walking and physical activity in the neighborhood	Item added by experts and cognitive testing	0.87
Pedestrian/traffic safety			0.83
	Heavy traffic along nearby streets		0.77
	Slow speed of traffic along nearby streets		0.63
	Drivers exceed speed limits in neighborhood		0.60
	Crosswalks and pedestrian signals available to help cross busy streets		0.57
	High exhaust fumes from motor vehicles		0.76
Crime Safety			0.88
	Streets are well lit		0.85
	Walkers/bikers can be seen by people in their homes		0.64
	See and speak to others when walking in the neighborhood	Item added from NEWS original	0.88
	High crime rate in the neighborhood		0.88
	Crime rate makes the neighborhood unsafe to walk in during the day		0.77
	Crime rate makes the neighborhood unsafe to walk in at night		0.89

# There was not enough variability in responses to evaluate reliability

## Discussion

This study has focused on the systematic adaptation process of the NEWS measure for Iran. It also documents the test-retest reliability of the adapted version called NEWS-Iran.

The results show that NEWS-Iran is a feasible and reliable measure for assessing perceptions of the built environment consistent with social, cultural and urban characteristics of Iran. It can be used for further studies in fields such as medicine, urban design and urban planning.

“To conduct research studies that test environmental hypotheses, it is essential to improve measurement of environmental variables. Some of the main sources of environmental measures are surveys and observational data that can be aggregated into larger units and compared across subgroups” (17).

The stated adaptation process was used in similar studies for adapting NEWS or an

environmental measure to a new urban context (15,21).

This study also shows that NEWS-Iran has appropriate reliability. The reliability score in all subscales showed the highest reliability (ranged from 0.82 to 0.92). For individual items, the results showed moderate to almost perfect reliability, ranging from 0.52 for “access to daily services” in the Land use Mix-Diversity subscale to 0.96 for “1-3 stories row houses” in the Residential Density subscale.

The test-retest reliability scores discussed here for NEWS-Iran are comparable to the findings from the original and adapted NEWS reliability studies. Table 2 shows the subscales reliability scores among different NEWS reliability studies performed inside and outside of the United States (as the origin of the NEWS measure).

For example the original version of NEWS reported the reliability scores ranging from ICC=0.58 to 0.80 and in compari-

Table 2. Test-retest reliability scores of the subscales of the original and adapted NEWS questionnaires

Subscales scores	NEWS versions				
	NEWS (Original) (8)	NEWS-2004 (17)	NEWS-Australia (22)	NEWS-Nigeria (15)	NEWS-Iran
Residential Density	0.63	0.78	0.78	0.66	0.92
Land use mix	0.78	0.93	0.88	0.87	0.91
Land use access	0.79	0.77	0.80	0.76	0.82
Street Connectivity	0.63	0.41	0.74	0.72	0.90
Walking facilities	0.58	0.76	0.76	0.59	0.86
Aesthetics	0.79	0.66	0.86	0.91	0.88
Traffic Safety	0.77	0.69	0.62	0.65	0.83
Safety from crime	0.80	0.64	0.63	0.66	0.88

son NEWS-Iran has higher reliability scores.

The subscale on “residential density” demonstrated the highest reliability coefficients in this study. The “1-3 stories row houses” in this subscale has the highest ICC score in the questionnaire (0.96). This is related to the questionnaire’s ability to transfer the correct meaning of the housing type which can be attributed into the example pictures accompanying the questionnaire. We think that adding examples (either in the form of pictures or scenarios) to questionnaires will greatly increase their effectiveness.

As mentioned in another related study (17) the reason that some items are less reliable is the probability that these items such as “availability of parking at stores” and “traffic patterns” vary on the time of day or during different days of the week and may not be suitable for point-in-time reliability testing.

#### *Study Contributions*

This study has some significant strength points. One study strength was the systematic adaptation process which was also used in similar studies in developing countries, for example in the adaptation of NEWS for Nigeria (15), or NEWS for Chinese Seniors (13). Using this process enabled us to incorporate a multidisciplinary panel of local experts which helped to reflect Iran-specific context and conditions. Another strength of the study was sticking to the explicit goal to maintain as many of the original items as possible while tailoring the measure for Iran, as was recommended

by IPEN, to allow for international comparison of data gathering, analysis methods and the study results. Consequently this study has developed a measure comparable to those studies in other countries especially those collaborate in IPEN programs. Studies conducted on the validity and reliability of the NEWS and NEWS-A questionnaires across many countries (23) can lead to international evidence about the associations of the built environment with physical activity and could inform international and national policies and guide the implementation of international health strategies (24).

#### *Study Limitations*

The first limitation of the study is the low response rate for the second test (39%) which resulted in a small sample size (N=19) for analysis. However, because this study was not developed to measure prevalence, the reliability results should not be subject to substantial bias. Other similar reliability studies have shown response rates from 13% to 54% and many reliability studies have relied on convenience samples. Both the length of the survey (completion time) and the content areas may be factors in the low baseline response rate (17). Another limitation of the study is the use of a convenience sample as was used in other studies (22). This study includes postgraduate students of urban design and planning department, who were different in socioeconomic status. This resulted in high scores of the reliability test which is similar to other studies (3). As mentioned in other studies (23) another limitation is the chang-

es in the environments, behaviors and events during the time of two surveys. Although this is an unlikely event because of the short time between two surveys (15 days), it might have weakened the reported reliability estimates.

### Conclusion

Assessing the built environment features related to physical activity is very important. NEWS is one of the most applicable and used measures for perceived environment at neighborhood scale. This study introduced NEWS-Iran, which is a reliable version of NEWS for measuring environmental perceptions related to physical activity behavior adapted for Iran.

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### References

1. WHO. Prevalence of insufficient physical activity among adults. [Online].; 2010 [cited 2015 12 19]. Available from: <http://apps.who.int/gho/data/node.main.A893?lang=en> <http://apps.who.int/gho/data/node.main.A893?lang=en> .
2. Sheikholeslam R, Mohamad A, Mohammad K, Vaseghi S. Non-communicable disease risk factors in Iran. *Asia Pac J Clin Nutr* 2004;131(Suppl): S100.
3. Spittaels H, Verloigne C, Gidlow J, Gloanec S, Titze C, Foster J, et al. Measuring physical activity-related environmental factors: reliability and predictive validity of the European environmental questionnaire ALPHA. *Int J Behav Nutr Phys Act* 2010;7(48).
4. Brownson RC, Hoehner CM, Day K, Forsyth A, Sallis JF. Measuring the Built Environment for Physical Activity: State of the Science. *Am J Prev Med* 2009 April;36(4Suppl):S99-123.
5. Sallis JF, Johnson MF, Calfas KJ, Caparosa S, Nichols JF. Assessing perceived physical environmental variables that may influence physical activity. *Res Q Exerc Sport* 1997;68(4):345-51.
6. Group S49R. Environmental Supports for

Physical Activity Questionnaire. Norman J. Arnold School of Public Health, University of South Carolina, Prevention Research Center; 2002.

7. King A, Castro C. Personal and environmental factors associated with physical inactivity among different racial-ethnic groups of US middle-aged and older-aged women. *Health Psychol* 2000;19(4): 354-364.
8. Saelens BE, Sallis JF, Black JB, Chen D. Neighborhood-based differences in physical activity. An environment scale evaluation *Am J Public Health* 2003;93:1552-1558.
9. Cerin E, Macfarlane DJ, Ko HH, Chan KC. Measuring perceived neighborhood walkability in Hong Kong. *Cities* 2007;24:209-217.
10. Shigematsu R, Sallis JF, Conway TL, Saelens BE, Frank LD, Cain KL, et al. Age differences in relation of perceived neighborhood environment to walking. *Med Sci Sports Exerc* 2009;41:314-321.
11. De Melo LL, Menec V, Porter MM, Ready AE. Personal factors, perceived environment, and objectively measured walking in old age. *J Aging Phys Act* 2010;18:280-291.
12. Van Dyck D, Cardon G, Deforche B, Sallis JF, Owen N, De Bourdeaudhuij I. Neighborhood SES and walkability are related to physical activity behavior in Belgian adults. *Prev Med* 2010;50:S74-S79.
13. Cerin E, Sit C, Cheung M, Ho S, Lee L, Chan W. Reliable and valid NEWS for Chinese seniors: measuring perceived neighborhood attributes related to walking. *Int J Behav Nutr Phys Act* 2010;7(84).
14. Inoue S, Ohya Y, Odagiri Y, Takamiya T, Ishii K, Lee JS, et al. Reliability of the abbreviated neighborhood environment walkability scale Japanese version. *Jpn. J. Phys. Fitness Sports Med* 2009;58(4):453-461.
15. Oyeyemi AL, Sallis JF, Deforche B, Oyeyemi AY, De Bourdeaudhuij I, Van Dyck D. Evaluation of the neighborhood environment walkability scale in Nigeria. *Int J Health Geogr* 2013;12(16).
16. KF G. Cross-cultural normative assessment: Translation and adaptation issues influencing the normative interpretation of assessment instruments *Psychol Assess* 1994;(6):304-312.
17. Brownson RC, Chang JJ, Eyster AA, Ainsworth, Kirtland KA, Saelens BE, et al. Measuring the environment for friendliness toward physical activity: A comparison of the reliability of three questionnaires. *Am J Public Health* 2004;94(3): 473-483.
18. Saelens BE, Sallis JF, Frank LD. Environmental correlates of walking and cycling: findings from the transportation, urban design, and planning literature *Ann Behav Med* 2003;25:80-91.
19. IPEN. Adapting and Developing Measures, Including Formative Studies. [Online]. [cited 2012]. Available from: [http://www.ipenproject.org/methods\\_surveys.html#Core](http://www.ipenproject.org/methods_surveys.html#Core) .
20. Landis J, Koch G. The measurement of



observer agreement for categorical data. *Biometrics* 1977;33:159-74.

21. Oyeyemi AA, Sallis J, Oyeyemi A, Amin M, De Bourdeaudhuij I, Deforche B. Adaptation, test-retest reliability, and construct validity of the Physical Activity Neighborhood Environment Scale in Nigeria (PANES-N). *J Phys Act Health* 2013; 10(8):1079-90.

22. Evenson K, McGinn A. Test-retest reliability of a questionnaire to assess physical environmental factors pertaining to physical activity *Int J Behav*

*Nutr Phys Act* 2005;2(1).

23. McGinn AP, Evenson KR, Herring AH, Huston SL. The relationship between leisure, walking, and transportation activity with the natural environment. *Health Place* 2007;13:588-602.

24. Leslie E, Saelens B, Frank LD, Owen N, Bauman A, Coffee N, et al. Residents' perceptions of walkability attributes in objectively different neighborhoods: a pilot study. *Health Place* 2005; 11:227-236.