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Evaluating a Brief Self-Report Measure of Neighborhood Environments for Physical Activity Research and Surveillance: Physical Activity Neighborhood Environment Scale (PANES)

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Background: Neighborhood environment attributes of walkability and access to recreation facilities have been related to physical activity and weight status, but most self-report environment measures are lengthy. The 17-item PANES (Physical Activity Neighborhood Environment Scale) was developed to be comprehensive but brief enough for use in multipurpose surveys. The current study evaluated test-retest and alternate-form reliability of PANES items compared with multi-item subscales from the longer NEWS-A (Neighborhood Environment Walkability Scale—Abbreviated). ***Methods:*** Participants were 291 adults recruited from neighborhoods that varied in walkability in 3 US cities. Surveys were completed twice with a 27-day interval. ***Results:*** Test-retest ICCs for PANES items ranged from .52 to .88. Spearman correlations for the PANES single item vs NEWS-A subscale comparisons ranged from .27 to .81 (all $P < .01$). ***Conclusions:*** PANES items related to land use mix, residential density, pedestrian infrastructure, aesthetic qualities, and safety from traffic and crime were supported by correlations with NEWS-A subscales. Access to recreation facilities and street connectivity items were not supported. The brevity of PANES allows items to be included in studies or surveillance systems to expand knowledge about neighborhood environments.

Keywords: built environment, exercise, health promotion, policy, transportation, obesity

Neighborhood environment attributes are consistent correlates of physical activity, as documented by numerous reviews[1–3] and reports from a Transportation Research Board-Institute of Medicine[4] panel and the Task Force for Community Preventive Services.[5] Different neighborhood attributes are related to different types and purposes of physical activity.[6] Briefly, living in walkable neighborhoods, characterized by a mixture of land uses, connected streets, and high residential density, is positively related to active transportation, and living in close proximity to public and private recreation facilities and sidewalks is positively related to active recreation.[1–3] These kinds of "activity-supportive" environments also have been associated with lower rates of overweight and obesity.[7,8] Thus, the U.S. Institute of Medicine,[9] the U.S. Surgeon General,[10] and the World Health Organization,[11] have recommended built environment changes as part of comprehensive efforts to control the obesity epidemic.

Neighborhood environment attributes assessed by direct observation, geographic information systems, and self-reports have been related to physical activity and weight status.[1–3,8] There are numerous objective and self-report neighborhood environment measures with evidence of reliability and validity,[12] but these measures have important limitations. None of the existing measures is feasible for routine inclusion in public health surveillance systems, and this is a key limitation as built environments rise on the list of public health priorities.[13] Direct observations of neighborhood attributes are expensive, and with 1 exception,[14] they have not been designed for use by nonresearchers. Detailed land use and active transportation infrastructure data for use in geographic information systems are lacking in many areas. Current self-report measures of environments are lengthy, but brief, reliable, and valid self-report instruments could be incorporated into surveillance systems and applied widely in research.

Brownson and colleagues[12] identified 20 environmental self-report surveys with evidence of reliability and/or validity, ranging from 7 to 68 items. Although

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several of the scales had fewer than 15 items, they did not reflect the range of neighborhood attributes associated with physical activity for transportation and recreation purposes, so they could be considered incomplete. One of the brief measures in the Brownson et al[12] review, the "environmental module" from the International Prevalence Study of Physical Activity (renamed here, Physical Activity Neighborhood Environment Scale (PANES)) was developed to assess the neighborhood environment attributes with the most conceptual and empirical support, be brief enough for use in a multipurpose survey, and adaptable enough to be used internationally. The measure was shown to have good test-retest reliability in Swedish and Nigerian samples.[15,16] Specifically, intraclass correlation coefficients (ICC) for the 17 items in 98 Swedish adults ranged from 0.36 for safety from crime during the day to 0.98 for motor vehicles in the household.[15] Similarly, a study of 16 items in 103 Nigerian students reported ICCs ranging from 0.43 for safety from crime during the day to 0.91 for many interesting things to look at in the neighborhood (ie, aesthetics). Construct validity was supported by the finding that 5 of 7 items in an international study were significantly related to physical activity.[17]

These promising early results justify further evaluation of the PANES. The purpose of the current study was to document test-retest reliability in a third country (ie, United States) and evaluate equivalence of PANES items to multi-item scales measuring the same constructs from the longer, validated NEWS-A (Neighborhood Environment Walkability Scale—Abbreviated).[18]

Methods

Participants

The design of the study and procedures are outlined briefly here, and more detail can be found elsewhere.[19–21] The aim of the larger study, named "Active Where?," was to develop and evaluate built, food, and home environmental surveys tailored to the needs of children and adolescents. The measures reported in the present paper were subsets of surveys completed by parents. Participants were parents of youth aged 5 to 18 years old recruited from Cincinnati, OH, San Diego, CA, and Boston, MA. To maximize land use and sociodemographic variability in the neighborhoods where participants lived, recruitment was conducted in selected neighborhoods within these cities that varied in walkability (number of destinations to walk to, residential density and number of street intersections) and household income. Recruitment methods included mail and telephone contact of potential participants identified by a commercial marketing firm and in-person contact through schools, community events, and recreation facilities. Response rates varied, from 15% to 73%, by city and recruitment method. Most participants completed the same survey at 2 time points. Average time between completions was 27 days. Participants received a $20 incentive for participating. The study was approved by the institutional review boards of participating research institutions (San Diego State University, University of Cincinnati, Children's Hospital of Boston).

Data from 291 parents were collected, but some were excluded from present data analyses based on incompleteness of responses. Surveys were excluded from the equivalence reliability analysis if the participant did not complete all PANES items for time 1, with the exception of items 13 and 14 (see Table 1), which were the most frequently skipped. Based on this screening, 232 surveys from time 1 were retained for equivalence reliability analyses. The characteristics of 232 complete responders to the time 1 survey were: 72.8% non-Hispanic white, 81.8% female, 51.7% with a college degree, 64.2% with an annual household income greater than $50,000, and a mean age of 42.9 (SD 7.2) years. Demographic characteristics of participants are reported by city in a table available at www.drjamessallis.sdsu.edu. For the test-retest reliability analysis, data were used from participants who had any data at both time points. The test-retest reliability sample size ranged from 195 to 212, with the exception of PANES items 13 (N = 186), and 14 (N = 95).

Measures

Physical Activity Neighborhood Environment Scale (PANES). The PANES is a 17-item survey assessing the perceived neighborhood environment developed for the International Prevalence Study of Physical Activity (IPS). The aim of IPS was to collect nationally representative and internationally comparable prevalence estimates on physical activity from a diverse set of countries, and results from 20 countries have been reported.[22] A neighborhood environment survey was developed by 2 of the authors (JFS, BEA) for use in the IPS with the goal of using pooled data from multiple countries to maximize environmental variability beyond what was possible in single-country studies. The instrument was previously referred to as the IPS environmental module.[15,16] All surveys were self-administered in the current study, the same mode used in the 2 previous reliability studies.[15,16]

Each PANES item assessed a built or social environment attribute shown in previous studies to be related to physical activity for recreation[2,3,23] or transportation[3–5] or hypothesized to be related to physical activity.[24–26] Items were taken or adapted from previously evaluated surveys of neighborhood environments.[18,27,28] The items are listed in Table 1, and the main constructs were residential density (item 1), land use mix (items 2 & 17), street connectivity (item 12), proximity to neighborhood recreation facilities (item 6), pedestrian infrastructure (items 4 & 13), bicycling infrastructure (items 5, & 14), aesthetic qualities (item 10), social cues for physical activity (item 9), traffic safety (items 8 & 15), crime safety (items 7 & 16) and access to a working automobile (item 11).

Neighborhood was defined on the survey as the area within a 10 to 15 minute walk from home. With the exception of item 1 on the main type of housing in the

Table 1 Time 1 Descriptive Statistics and Test-Retest Coefficients for PANES Items, as Both Continuous and Dichotomous Variables

	Time 1 (N = 232**)		Test retest coefficients				
Item content	Mean (SD)	% reporting agree or strongly agree with item	N	ICC	95% Confidence Interval	Kappa (for dichotomized scale)	% agreement (for dichotomized scale)
1. What is the main type of housing in your neighborhood?	1.58 (0.88)	67.7*	201	.612	.518–.692	.701	86.1
2. Many shops, stores, markets or other places to buy things I need are within easy walking distance of my home.	2.76 (1.12)	63.8	209	.631	.542–.706	.506	78.0
3. It is within a 10-15 minute walk to a transit stop (such as bus, train, trolley, or tram) from my home.	3.43 (1.03)	83.6	205	.618	.526–.696	.484	85.4
4. There are sidewalks on most of the streets in my neighborhood.	3.53 (0.96)	85.8	208	.756	.691–.809	.687	92.8
5. There are facilities to bicycle in or near my neighborhood, such as special lanes, separate paths or trails, shared use paths for cycles and pedestrians.	2.27 (1.24)	44.7	195	.627	.534–.705	.566	78.7
6. My neighborhood has several free or low cost recreation facilities, such as parks, walking trails, bike paths, recreation centers, playgrounds, public swimming pools, etc.	2.98 (1.05)	73.7	204	.529	.423–.621	.346	75.0
7. The crime rate in my neighborhood makes it unsafe to go on walks at night. (reverse coded)	2.82 (1.09)	39.2	208	.747	.680–.801	.666	83.6
8. There is so much traffic on the streets that it makes it difficult or unpleasant to walk in my neighborhood. (reverse coded)	2.81 (1.04)	40.9	208	.653	.568–.725	.497	75.5
9. I see many people being physically active in my neighborhood doing things like walking, jogging, cycling, or playing sports and active games.	3.23 (0.91)	84.1	208	.673	.592–.741	.536	85.6
10. There are many interesting things to look at while walking in my neighborhood.	3.09 (0.87)	78.9	208	.621	.531–.698	.600	85.5
11. How many motor vehicles in working order are there at your household?	2.28 (1.11)	NA	195	.877	.840–.905	NA	NA
12. There are many 4-way intersections in my neighborhood.	3.05 (0.96)	75.0	202	.518	.409–.612	.415	78.3
13. The sidewalks in my neighborhood are well maintained (paved, with few cracks) and not obstructed.	3.10 (0.98)	77.6	186	.610	.511–.693	.472	80.5
14. Places for bicycling (such as bike paths) in and around my neighborhood are well maintained and not obstructed	3.08 (0.93)	74.2	95	.749	.645–.825	.439	79.1
15. There is so much traffic on the streets that it makes it difficult or unpleasant to ride a bicycle in my neighborhood. (reverse coded)	2.46 (1.01)	56.9	206	.592	.496–.674	.467	73.8
16. The crime rate in my neighborhood makes it unsafe to go on walks during the day. (reverse coded)	3.47 (0.82)	14.7	208	.587	.490–.669	.538	86.0
17. There are many places to go within easy walking distance of my home.	2.97 (1.05)	70.3	209	.739	.671–.795	.649	86.1
Neighborhood Environment Index	3.94 (1.49)	NA	183	.701	.623–.766	NA	NA

* Item 1 was dichotomized as "single family, detached" versus all other housing types.

** Item 13 N = 210, Item 14 N = 127

neighborhood, items were phrased as statements about an attribute of their neighborhoods, with the following response options and values: 1, strongly disagree; 2, somewhat disagree; 3, somewhat agree; 4, strongly agree; don't know/not sure; or refused to answer. For types of housing, "detached single family" indicated low residential density and was compared with all others, such as apartment/condo buildings of various heights and a mix of housing types. The "don't know/not sure" or "refused" responses were not used in data analyses. With the exception of items 7, 8, 15, and 16, PANES items are typically scored so that higher scores correspond with higher neighborhood walkability. For the purpose of this study, items 7, 8, 15, and 16, which inquired about crime and traffic safety, were reverse coded so that higher scores corresponded with higher neighborhood walkability. Items 13 and 14 inquired about pedestrian and bicycling infrastructure maintenance. If such facilities were reported as not present, many participants did not respond; hence the lower response rates for these 2 items. It is also likely that participants who do not cycle did not respond to item 14. Due to low response rates, items 13 and 14 were excluded from the equivalence reliability analyses.

In IPS analyses, a Neighborhood Environment Index was constructed to test the hypothesis that more reported activity-supportive attributes in the neighborhood would be positively associated with physical activity, and this was supported in a previous paper.[17] The Index was composed of the 6 dichotomized built environment items (item numbers 1 to 6) available from all 11 countries in the earlier study, and scores ranged from 0 to 6 with higher scores indicating a more favorable built environment for physical activity.[17]

Neighborhood Environment Walkability Scale—Abbreviated (NEWS-A). NEWS-A was used in the current study to assess equivalence or alternate-form reliability of PANES because the instruments were designed to assess the same constructs. The NEWS-A was itself derived from the original NEWS, a 68-item survey of neighborhood environment attributes.[18] Whereas PANES measured each construct with 1 to 2 items, NEWS and NEWS-A used multi-item subscales. Reliability and validity of the NEWS have been documented in 3 countries.[14,18,29–31] Most subscales had test-retest reliability ICC's > .75. An abbreviated version (NEWS-A) with 54 items was empirically derived, with items dropped based on lower test-retest reliability, contribution to factor correlations with physical activity, or theoretical salience.[32] All NEWS-A subscales were shown to correlate significantly with adult physical activity. Correlations with walking for transport or recreation were similar for NEWS and NEWS-A subscales, and surprisingly, correlations tended to be higher for several NEWS-A subscales.[32] A slightly reduced version of NEWS-A was used for the current study. Number of housing types was reduced from 6 to 4 options, and 4 single-items that were not part of any scales were omitted; ie, parking is difficult in local shopping areas; the streets in my neighborhood do not have many cul-de-sacs; the streets in my neighborhood are hilly, making my neighborhood difficult to walk in; there are major barriers to walking in my neighborhood that make it hard to get from place to place.

Because PANES was largely modeled after NEWS-A, the response formats were the same, with 2 exceptions. The NEWS-A residential density items required a rating for each of 6 housing types (4 types in the current study). Two of the NEWS-A subscales concerned land use (land use mix-diversity and land use mix-access). For the land use mix-diversity subscale, participants were asked to indicate the distance in minutes to walk to local destinations from their home. The distance categories were 1 to 5 minutes, 6 to 10 minutes, 11 to 20 minutes, 21 to 30 minutes, 30+ minutes, and "don't know." "Don't know" answers were combined with the 30+ minute category. To score the land use mix-diversity subscale, the number of destinations reported to be within a 10-minute walk from home was tallied. To enhance independence of reporting, NEWS-A was positioned early in the parent survey, and PANES was at the end.

Neighborhood Recreation Facilities. The original NEWS-A contained 3 types of recreation facilities in the list of destinations in the "land use mix-diversity" subscale. The "Active Where?" parent survey contained a new expanded measure of proximity to 14 recreation facilities, including indoor facilities, walking/hiking trails, YMCAs, swimming pools, parks, and public open spaces (see www.drjamessallis.sdsu.edu). For each of the 14 facilities, participants reported the time required to walk to each destination, using the same scale as the "land use mix-diversity" subscale of the NEWS-A. The new recreation facility measure was based on the "convenient facilities" checklist that was found to have a test-retest ICC of 0.80 and a significant correlation with reported vigorous physical activity ($r = .19$, $P < .05$).[33] The Neighborhood Recreation Facilities scale was scored 2 ways in the current study. First, the number of facilities reported to be within a 10-minute walk from home was tallied. Second, a subset of 9 facilities likely to be "free or low cost," as specified in the PANES item, within a 10-minute walk were tallied: beach/lake/river/creek, bike/hiking/walking trails or paths, basketball court, other playing fields/courts, school with recreation facilities, small public park, large public park, public playground with equipment, and public open space.

Statistical Analysis

Data were analyzed using Statistical Package for the Social Sciences (SPSS), Version 16.0.[34] To examine test-retest reliability of the PANES, 1-way random single measure intraclass correlation coefficients (ICC) were calculated for each item as a 4-point scale. Items were then dichotomized as they were for the IPS analyses (somewhat agree/strongly agree vs somewhat disagree/strongly disagree)[17] and Cohen's Kappa coefficients were computed

between scores to take into account agreement occurring by chance.[35] For Cohen's Kappa coefficients, .21 was considered fair agreement, .41 was considered moderate agreement, .61 was considered substantial agreement, and anything above .80 was considered almost perfect agreement.[36] Percent agreement, which indicates the proportion of exact agreement, was also calculated by examining the cross tabulation for each item. The test-retest reliability of the 6-item Neighborhood Environment Index[17] was examined using ICC.

Subscales of the NEWS-A items were created as indicated from previous studies to include residential density, land use mix-diversity, land use mix-access, street connectivity, pedestrian infrastructure, aesthetic qualities, traffic safety, and crime safety.[18,32] Most of the subscales were mean scores, but residential density was a weighted scale.[18] For all subscales, higher scores corresponded with higher neighborhood walkability. To examine test-retest reliability of continuous-measure NEWS-A and Neighborhood Recreation Facility subscales, 1-way random single measure ICCs were calculated.

Equivalence or alternate-form reliability assesses the extent to which one scale can be substituted for another.[37] Subscales from the NEWS-A and Neighborhood Recreation Facilities were matched with conceptually corresponding PANES items, and Spearman correlations between measures were examined. A summary score was also calculated for the NEWS-A/Neighborhood Recreation Facilities subscales by computing, then summing, z-scores for NEWS-A/Neighborhood Recreation Facility subscales that conceptually matched items from the Neighborhood Environment Index (PANES item #'s 1 to 6). The NEWS-A/Neighborhood Recreation Facilities summary score was compared with the Neighborhood Environment Index using Spearman correlation coefficients. For ICCs, .5 was considered moderate and .7 high;[38] for Spearman correlations .5, equivalent to a large effect size for a Pearson correlation coefficient,[39] was considered acceptable.

Results

Time 1 means (and SDs) and test-retest results for PANES are presented in Table 1 and for NEWS subscales in Table 2. Test retest ICCs for PANES items ranged from .52 to .88, Cohen's Kappa ranged from .35 to .70, and percent agreement ranged from 74% to 93%. Test-retest ICC for the PANES 6-item Neighborhood Environment Index was .70. For the NEWS-A subscales, ICCs ranged from .55 to .80 (Table 2).

As shown in Table 3, Spearman correlations for the PANES single item vs NEWS-A and Neighborhood Recreation Facility subscale comparisons ranged from .27 to .81, and all were significant at the 0.01 level. Nine of the 14 PANES item by NEWS-A/Neighborhood Recreation Facility subscale matches produced correlation coefficients greater than .5, and 4 were greater than .6. The proximity to neighborhood recreation facilities item (item 6) and the street connectivity item (item 12) from the PANES demonstrated the weakest correlations with corresponding NEWS-A/Neighborhood Recreation Facility subscales. PANES items assessing land use mix (items 2 & 17), crime safety (item 7), and aesthetic qualities (item 10) demonstrated the strongest correlation coefficients with corresponding NEWS-A subscales. The correlation between the Neighborhood Environment Index from the PANES and the NEWS-A/Neighborhood Recreation Facility summary score was .57.

Table 2 Time 1 Descriptive Statistics and Test-Retest Intraclass Coefficients (ICC) for NEWS-A and Neighborhood Recreation Facility Subscales

Subscale [scale range]	Number of items	Time 1 mean (SD) (N = 232)	Test retest ICC (N = 212)	95% CI
Land use mix-diversity (count of shops in 10 minute walk) [1–20]	20	6.43 (5.70)	.779	.721–.827
Residential density (weighted score) [177–473]	4	92.02 (36.99)	.755	.691–.808
Mean land use mix-access [1–4]	3	2.84 (0.93)	.668	.586–.736
Mean street connectivity [1–4]	2	2.86 (0.83)	.553	.452–.640
Mean pedestrian infrastructure [1–4]	6	2.89 (0.67)	.749	.684–.803
Mean aesthetic qualities [1–4]	4	3.13 (0.72)	.664	.582–.733
Mean traffic safety [1–4]	3	2.26 (0.70)	.591	.496–.672
Mean crime safety [1–4]	3	2.98 (1.01)	.800	.746–.844
Proximity to neighborhood recreation facilities (count of recreation facilities in 10 minute walk) [1–14]	14	4.36 (3.31)	.694	.617–.757
Proximity to neighborhood recreation facilities (count of "free or low cost" recreation facilities in 10 minute walk) [1–9]	9	3.37 (2.59)	.729	.660–.786
NEWS-A/NRF summary score (only scales that correspond with NEI/PANES items 1–6)	NA	NA	.858	.819–.890

Abbreviations: CI, confidence interval.

Table 3 Spearman Correlations Between PANES Single Items and Conceptually Corresponding Multi-Item NEWS-A and Neighborhood Recreation Facility Subscales at Time 1 (N = 232)

PANES single item	NEWS subscale	Spearman *r*	95% CI
1. What is the main type of housing in your neighborhood?	Residential density	.535	.436–.621
2. Many shops, stores, markets or other places to buy things I need are within easy walking distance of my home.	Land use mix-diversity (Count of shops in 10 minute walk)	.516	.415–.700
2. Many shops, stores, markets or other places to buy things I need are within easy walking distance of my home.	Land use mix-access	.672	.595–.737
4. There are sidewalks on most of the streets in my neighborhood.	Pedestrian infrastructure	.520	.419–.608
6. My neighborhood has several free or low cost recreation facilities, such as parks, walking trails, bike paths, recreation centers, playgrounds, public swimming pools, etc.	Proximity to neighborhood recreation facilities (Count of 14 recreation facilities in 10 minute walk)	.265	.141–.381
6. My neighborhood has several free or low cost recreation facilities, such as parks, walking trails, bike paths, recreation centers, playgrounds, public swimming pools, etc.	Proximity to neighborhood recreation facilities (Count of 9 "free or low cost" recreation facilities in 10 minute walk)	.305	.183–.417
7. The crime rate in my neighborhood makes it unsafe to go on walks at night. (reverse coded)	Crime safety	.806	.756–.847
8. There is so much traffic on the streets that it makes it difficult or unpleasant to walk in my neighborhood. (reverse coded)	Traffic safety	.578	.485–.658
10. There are many interesting things to look at while walking in my neighborhood.	Aesthetic qualities	.614	.527–.688
12. There are many 4-way intersections in my neighborhood.	Street connectivity	.338	.219–.447
15. There is so much traffic on the streets that it makes it difficult or unpleasant to ride a bicycle in my neighborhood. (reverse coded)	Traffic safety	.499	.396–.590
16. The crime rate in my neighborhood makes it unsafe to go on walks during the day. (reverse coded)	Crime safety	.592	.501–.670
17. There are many places to go within easy walking distance of my home.	Land use mix-diversity (Count of shops in 10 minute walk)	.497	.393–.588
17. There are many places to go within easy walking distance of my home.	Land use mix-access	.628	.543–.700
Neighborhood Environment Index	NEWS-A/NRF summary score (only scales that correspond with NEI/PANES items 1–6)	.569	.475–.650

Abbreviations: CI, confidence interval.

Note. All correlation coefficients were statistically significant at $P < .01$. PANES items 3, 5, 9, 11, 13, & 14 were excluded from the analysis.

Discussion

Test-retest reliability of all PANES continuously-scored items was supported in a relatively large and diverse US sample, and 8 PANES items were shown to be substantially equivalent to multi-item scales from the NEWS-A and Neighborhood Recreation Facility subscales assessing the same constructs. Present findings generally replicated good test-retest reliability findings in Swedish[15] and Nigerian[16] samples, though reliabilities for crime safety were higher in the current study. Thus, many of the PANES items have empirical support for use as brief measures of physical activity-related neighborhood environment attributes. However, further evaluation is needed to document test-retest reliability in additional countries, examine equivalence reliability of items that could not be assessed in the current study, and validate as many PANES items as possible against objective environmental measures.

Residential density (item 1), land use mix (items 2 and 17), pedestrian infrastructure (item 4), aesthetic qualities (item 10), traffic safety (items 8 and 15), and crime safety (items 7 and 16) were the neighborhood attributes with strongest support for being adequately assessed by PANES items. Additional items had acceptable test-retest reliabilities but could not be assessed for

equivalence with NEWS-A subscales, such as access to transit (item 3), bicycling infrastructure (item 5), and people being active in the neighborhood (item 9). Items assessing proximity to neighborhood recreation facilities (item 6) and street connectivity (item 12) had the lowest test-retest and equivalence reliability correlations, and maintenance of pedestrian and bicycling infrastructure items (items 13 and 14) were too often skipped to be useful. To further explore equivalence reliability of the PANES recreation facilities variable, the 9-item subset of the Neighborhood Recreation Facility subscale likely to be "free or low cost" was compared with the PANES item. However, the Spearman correlation only increased from 0.265 to 0.305, and remained low. The correlation between the street connectivity item (item 12) and street connectivity subscale may have been attenuated by the lower test-retest reliability of these scales and because the PANES item was not included in the street connectivity subscale. Improved items to assess access to neighborhood recreation facilities and street connectivity need to be developed.

PANES items can be used as either continuous or dichotomized variables, and reliability of both formats was generally supported. As expected based on psychometric theory, test-retest reliability of PANES single items was lower than that of NEWS-A/Neighborhood Recreation Facility multi-item subscales. Though correlations of PANES items with NEWS-A/NRF subscales were all significant, and most exceeded the criterion for acceptability, it is clear PANES does not fully substitute for NEWS-A or Neighborhood Recreation Facility subscales, and some data quality will be lost. However, the brevity of PANES creates meaningful practical advantages that will allow PANES items to be included in studies or surveillance systems in which it would be impossible to include the NEWS-A, other longer scales,[12] or objective measures of the environment.

The Neighborhood Environment Index based on 6 PANES built environment items had a graded relationship with physical activity in an international study.[17] The current study demonstrated the Neighborhood Environment Index had strong test-retest reliability (ICC = .70), and good equivalence with a summary score based on NEWS-A/NRF subscales (r = .57). Because it is expected that the number or strength of "activity friendly" attributes will have a graded relationship with physical activity of residents, we encourage researchers to further investigate these and other neighborhood environment indexes.

An important limitation of the study was that only 11 of 17 PANES items could be evaluated for equivalence or alternate-form reliability, and validity was not evaluated against objective measures. The strong equivalence reliability correlations may not be surprising since PANES items were part of NEWS-A subscales in some instances. However, correlations were usually strong when the item was not part of the subscale, and it is useful to demonstrate that single items can adequately substitute for the subscale. Although PANES items did not have floor or ceiling effects in this sample, some of the dichotomized items exhibited limited variance, with up to 85% of participants on one side of the distribution, which could indicate limited discriminative validity. Another limitation was that the order of NEWS-A and PANES was not counterbalanced in the survey. The value of PANES items 13 and 14 is also questionable because maintenance of sidewalks and bicycle facilities cannot be rated if those facilities are not present. Generalizability of current findings to other US samples and to other countries needs to be assessed. As additional environmental correlates of physical activity are identified in research, it may be worthwhile to develop and evaluate new items for PANES.

Understanding how neighborhood environments can be built to support physical activity has been recognized as a priority by leading public health groups.[5,9,11] Environmental attributes have the potential to affect the behavior of entire communities over long periods of time, and environments can be changed permanently by policies.[40] Thus, research on built environments can inform specific policy recommendations to improve physical activity and health. Wider use of built environment measures could identify communities with the greatest needs for environmental changes as well as the specific attributes of most concern. A reliable brief self-report scale that could be incorporated into public health surveillance surveys could assist public health officials in understanding the environmental and policy change priorities for their communities. Research based on ecological models has the challenge of measuring and intervening on variables at the individual, social/cultural, physical environment, and policy levels,[41] and a psychometrically sound brief neighborhood environment scale could improve the feasibility and quality of such research. The present analyses supported most PANES items as reliable self-report measures of built and social environment variables relevant to physical activity. Numerous PANES items were strongly correlated with NEWS-A multi-item subscales. Thus, when long environmental surveys or objective measures are not feasible, PANES items can be used to assess neighborhood environment attributes for research and public health surveillance.

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