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Test Retest Reliability of Physical Activity Neighborhood Environment Scale among School Students in China

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Running Title

Physical Activity Neighborhood Environment Scale among Chinese Adolescents

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INTRODUCTION

It has been well documented that regular physical activity (PA) has important benefits for health.^{1,2} Currently, PA-friendly built environment (BE) has emerged as a promising approach for PA promotion at population level.²⁻⁶ It is of great importance to use reliable instruments to assess BE attributes for investigating its impact on PA among people. Geographic Information Systems (GIS) have been used to objectively measure BE correlates for public health purposes. However, the high cost and complicated technical support limit its wide use. Therefore, a reliable and easily applicable instrument is needed to assess BE attributes at population level. The “environmental module”, developed for the International Physical Activity Prevalence Study (IPS), provides a short-form environmental measure, the Physical Activity Neighborhood Environment Scale (PANES), (formerly named International Physical Activity Questionnaire Environmental Module, IPAQ E-Module) that can meet this need.⁷ The PANES has been shown to have good test-retest reliability in Swedish, Nigerian and USA adult samples, and it is usually adaptable for use in international studies with single items.⁸⁻¹⁰

Considering the rapid urbanization and the increasing prevalence of physical inactivity among adolescents in Mainland China (i.e., the average sedentary behavior time was about 70.0 hours per week among Chinese school students)⁵, it is of public health importance to identify built environmental factors that may influence PA in Chinese adolescents.

To examine the reliability of a Chinese version of the PANES (PANES-CHN) among urban Chinese school students, this test-retest study was conducted in urban areas of Nanjing, one of

the largest cities in eastern China. The first survey was conducted in early May of 2013, while the re-test survey was conducted seven days later. Written informed consents were obtained from participating schools, students and their parents/guardians. The Academic and Ethical Committee of Nanjing Municipal Center for Disease Control and Prevention reviewed and approved this study.

The participants were selected from grade 4 to 12 (about 10-18 years old) from primary and high schools using a multistage sampling method. First, two urban districts were randomly selected. Second, one school was randomly chosen from all primary, junior and senior high schools, respectively, within each selected district. Third, one class was randomly chosen from each grade within each selected school. All students within those selected classes were eligible participants. With Consideration of the overall sample size in previous similar studies (ranging from 98 to 298)⁷⁻⁹, to guarantee sufficient statistical power in each type of school (primary, junior and senior high school), the sample size in this study was estimated to be approximately 270 for each type of school (90 for each grade) and 810 in total. Actually, the final number of eligible participants were 884 based on such sampling approach.

The PANES-CHN was translated from the original English PANES through a strict and standardized procedure, including translation and back-translation, pilot study using initial PANES-CHN and panel review and assessment. In China, the apartments were built according to regulations as: (1) of 7 or less stories, usually without elevators; or (2) of 8 or more stories, compulsorily with elevators. Thus, the specific response options for item one,

regarding main type of housing, were modified to include these options. The full PANES-CHN was shown as an appendix.

The PANES consisted of 17 items regarding attributes of local BE with the ‘neighborhood’ specifically defined as a 10- to 15-min walk distance from the home. These 17 questions were categorized into three subgroups: seven core items (consisting of residential density, access to destinations, neighborhood infrastructure and neighborhood safety), four recommended items (comprising neighborhood safety, social environment, aesthetic qualities and household motor vehicle) and six optional items (including access to destinations, neighborhood infrastructure, street connectivity and neighborhood safety).

Four-point Likert response scales ranging from ‘strongly disagree’ to ‘strongly agree’, as well as ‘don’t know’ or ‘doesn’t apply’ options, were used for 15 questions with two exceptions: one is item 1, which asks about the main type of neighborhood housing (to assess residential density); the other is item 11 regarding the number of household motor vehicles (numerical value; ‘don’t know/not sure’).

The test-retest reliability for each environmental attribute was estimated using intraclass correlation coefficient (ICC) and percent agreement. The difference between these percent agreement within gender and school types were examined using chi-square analysis.

RELIABILITY OF PANES-CHN

Of the 884 eligible participants, 847 were recruited for the first-round survey (participating rate = 95.8%). One week later, all of those 847 students completed the retest survey (follow-up rate = 100%). The mean age of participants was 14.2 ± 2.6 (boys vs. girls: 14.0 ± 2.5 vs. 14.4 ± 2.7). There were 427 (50.4%) boys, 269 (31.8%) primary school students, 298 (35.2%) junior and 280 (33.1%) senior high school students.

Table 1 shows the ICC values and percent agreement for each built environmental item by gender and school type. Overall, the ICC ranged from 0.49 (item 6, regarding access to destinations) to 0.84 (item 1, regarding residential density) for the core item category, from 0.48 (item 10, regarding aesthetic qualities) to 0.62 (item 8, regarding neighborhood safety) for the recommended item category and from 0.42 (item 12 and 17, regarding street connectivity and access to destinations, respectively; the lowest ICC value among all 17 items) to 0.68 (item 16, regarding neighborhood safety) for the optional item category, while the item regarding the number of household motor vehicles got the highest ICC value of 0.96.

Among the 17 items, only item 1 was found to be significantly different in the percent agreement between boys and girls ($\chi^2=7.51$, $p<.05$), and item 12 was significantly different between primary and senior high schools ($\chi^2=7.03$, $p<.05$). Generally, there was no difference within gender and school type for the PANES-CHN questionnaire.

This is the first study assessing the test retest reliability of PANES within primary and high school students worldwide. There was a moderate reliability for the majority of items and

substantial reliability for a few items of the PANES-CHN among the students, regardless of their gender and school type (primary or high schools), suggesting that the PANES-CHN may be acceptable for use within the overall Chinese school students.

Although the participants were younger than their counterparts in previous studies, the findings of moderate reliabilities of PANES-CHN items were generally similar to those from other societies among adults.⁸⁻¹⁰ Compared to findings among adults, for the seven core items, five yielded lower and two generated higher ICC values, while for the recommended section, one half of the four items showed lower and the other half showed higher ICC scores in this study population.⁸⁻¹⁰

The highest ICC and percent agreement values were found for item one (main type of neighborhood housing) and item 11 (the number of household motor vehicles), which was similar to that found among adults.⁸⁻¹⁰ However, the lowest ICC values (0.42) were seen for items 12 regarding street connectivity and item17 regarding access to destinations (both from the optional section), which was in contrast to previous studies among adults.⁸⁻¹⁰

Adolescents are at the stage of body growth including physical and intellectual development, and of gradual adaptation to social, cultural and environmental context. They may have different sensitivity and judgment ability in relation to their neighborhood environment from adults. For example, it is relatively easier for adolescents to report the objective count or description (i.e., the number of household motor vehicle) than subjective rating (i.e., within

easy walking distance of my home). And China, the most populous society in the world, may have a different social and cultural context of neighborhood environment compared to other societies. Those may, at least in part, explain the difference of ICCs identified for several items in this study among Chinese adolescents from those in adults in other countries.

There are several factors influencing the test-retest reliability of the instrument. Time between survey administrations may affect the reliability of an instrument's test-retest. In this study, the interval between the two surveys was exactly 7 days, which would warrant the least change in neighborhood built environment attributes. Additionally, some subjectively perceived items, such as safety, may be influence by occasional events, however during the survey period there were no notable safety events reported by any local media coverage.

In summary, the test-retest reliability of the PANES-CHN was found to be moderate and generally acceptable within Chinese school students aged 10-18 years old. It provides an easy, convenient and reliable instrument to investigate the association of built environmental features with physical activity in Chinese adolescents.

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ETHICAL APPROVEMENT

The Academic and Ethical Committee of Nanjing Municipal Center for Disease Control and Prevention reviewed and approved this study in accordance with the internationally agreed ethical principles for medical research involving human subjects.

CONFLICT OF INTEREST

The authors have declared that no competing interests exist.

AUTHOR CONTRIBUTIONS

Conceived and designed the study: FX (the PI of the project), ZW and HZ. Data collection: FX, ZW and HZ. Analyzed the data: FX and ZW. Wrote and critically reviewed the paper: FX, EL, ZW, HZ and NO.

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Table 1. The Intraclass correlation coefficients (ICC) and percent agreement between two tests among students by gender and school type

Environmental variables†		ICC (percent agreement % between two tests)*					
		Overall (N=847)	Gender		School		
			Boys (n=427)	Girls (n=420)	Primary (n=269)	Junior high (n=298)	Senior high (n=280)
Core items							
1-RD	What is the main type of housing in your neighborhood?	0.84 (85.7)	0.82 (82.4)	0.86 (89.0*)	0.80 (82.9)	0.85 (85.2)	0.87 (88.9)
2-AD	Many shops, stores, markets or other places to buy things I need are within easy walking distance of my home	0.53 (65.3)	0.51 (63.7)	0.56 (66.9)	0.46 (64.7)	0.53 (65.8)	0.62 (65.4)
3-AD	It is within a 10-15 minutes walk to a transit stop from my home.	0.52 (65.2)	0.53 (63.9)	0.49 (66.4)	0.51 (62.5)	0.49 (66.8)	0.57 (66.1)
4-NI	There are sidewalks on most of the streets in my neighborhood.	0.58 (50.4)	0.58 (49.9)	0.58 (51.0)	0.56 (49.4)	0.61 (51.7)	0.59 (50.0)
5-NI	There are facilities to bicycle in or near my neighborhood shared use paths for cycles and pedestrians.	0.55 (48.1)	0.58 (48.2)	0.51 (47.9)	0.57 (48.7)	0.49 (47.3)	0.59 (48.6)
6-AD	My neighborhood has several free or low cost recreation facilities.	0.49 (48.2)	0.49 (48)	0.48 (48.3)	0.42 (49.1)	0.48 (48.6)	0.56 (47.1)

7-NS	The crime rate in my neighborhood makes it unsafe to go on walks at night.	0.66 (57.5)	0.63 (56.4)	0.69 (58.6)	0.65 (58.0)	0.69 (57.4)	0.63 (57.5)
Recommended items							
8-NS	There is so much traffic on the streets that it makes it difficult or unpleasant to walk in my neighborhood.	0.62 (50.6)	0.67 (50.1)	0.55 (51.2)	0.55 (48.3)	0.73 (52.0)	0.56 (51.8)
9-SE	I see many people being physically active in my neighborhood.	0.54 (59.0)	0.51 (57.6)	0.56 (60.5)	0.40 (58.7)	0.64 (58.7)	0.56 (59.6)
10-AQ	There are many interesting things to look at while walking in my neighborhood.	0.48 (55.8)	0.52 (57.4)	0.43 (54.3)	0.49 (58.0)	0.48 (54.0)	0.47 (55.7)
11-HV	How many motor vehicles in working order are there at your household?	0.96 (86.7)	0.95 (86.2)	0.97 (87.4)	0.97 (85.5)	0.94 (83.6)	0.92 (91.1)
Optional items							
12-SC	There are many four-way intersections in my neighborhood.	0.42 (48.4)	0.48 (47.3)	0.37 (49.5)	0.34 (41.6)	0.44 (50.7)	0.51 (52.9*)
13-NI	The sidewalks in my neighborhood are well maintained and not obstructed.	0.59 (52.9)	0.66 (54.3)	0.48 (51.4)	0.53 (52.0)	0.56 (49.3)	0.68 (57.5)
14-NI	Places for bicycling in and around my neighborhood are well maintained and not obstructed.	0.60 (51.8)	0.59 (53.9)	0.50 (49.8)	0.61 (54.3)	0.47 (48.3)	0.69 (53.2)
15-NS	There is so much traffic on the streets that it makes it difficult or unpleasant to ride a bicycle in my neighborhood.	0.62 (49.0)	0.64 (47.8)	0.59 (50.2)	0.67 (49.4)	0.52 (45.0)	0.68 (52.9)

16-NS	The crime rate in my neighborhood makes it unsafe to go on walks during the day.	0.68 (62.7)	0.66 (64.2)	0.69 (61.2)	0.60 (62.1)	0.78 (64.8)	0.64 (61.1)
17-AD	There are many places to go within easy walking distance of my home.	0.42 (53.0)	0.43 (55.0)	0.40 (51.0)	0.54 (54.6)	0.25 (49.0)	0.41 (55.7)

† Domains of built environmental features: RD-Residential Density; AD-Access to Destinations; NI-Neighborhood Infrastructure; NS-Neighborhood Safety; SE-Social Environment; AQ-Aesthetic Qualities; HV-Household motor vehicles; SC-Street Connectivity .

* $p < 0.05$ for the difference between percent agreement within gender, primary and senior high schools.

体力活动相关人居环境调查表（PANES-CHN）

说明：本调查表中所说的“社区”是指以你家为中心步行 10-15 分钟范围内的区域。下列 1-17 个问题均为单选题，所有问题均没有统一的标准答案、也没有对错之分，请你根据你本人以及所居住社区的具体情况逐题回答、并在你认为最适合的答案序号上打“√”。

1. 你所居住的社区里主要的房屋类型是什么？

- | | |
|-----------------------|------------------------|
| (1.) 独户别墅； | (2.) 联排别墅、多户 4 层以下层公寓； |
| (3.) 独户别墅与联排别墅、公寓的混合； | (4.) 7 层及以上的公寓； |
| (5.) 7 层以上的公寓； | (99.) 不知道或不好评价 |

2. 你家附近可以轻松步行的距离内，都所有必需的购物商店、市场、菜场等。你对这个说法的看法是下列哪一个？

- | | | |
|-------------|----------------|------------|
| (1.) 完全不同意； | (2.) 有些不同意； | (3.) 有些同意； |
| (4.) 完全同意； | (99.) 不知道或不好确定 | |

3. 从你家出发，10-15 分钟的步行距离内，有公共交通（公共汽车、地铁等公车）车站。
你对这个说法的看法是下列哪一个？

- | | | |
|-------------|----------------|------------|
| (1.) 完全不同意； | (2.) 有些不同意； | (3.) 有些同意； |
| (4.) 完全同意； | (99.) 不知道或不好确定 | |

4. 你所居住社区内的绝大多数道路都有人行道。你对这个说法的看法是下列哪一个？

- | | | |
|-------------|-----------------|----------------|
| (1.) 完全不同意； | (2.) 有些不同意； | (3.) 有些同意； |
| (4.) 完全同意； | (88.) 在我居住社区不适用 | (99.) 不知道或不好确定 |

5. 在你所住社区内或附近，道路上有自行车隔离车道。你对这个说法的看法是下列哪一个？

- (1.) 完全不同意； (2.) 有些不同意； (3.) 有些同意；
(4.) 完全同意； (88.) 在我居住社区不适用 (99.) 不知道或不好确定

6. 你所居住的社区内，有一些免费或收费很少的娱乐、锻炼设施，比如：公园、步行道、自行车道、娱乐中心、对社会开放的操场、公共游泳池等。你对这个说法的看法是下列哪一个？

- (1.) 完全不同意； (2.) 有些不同意； (3.) 有些同意；
(4.) 完全同意； (99.) 不知道或不好确定

7. 你所居住社区内，由于犯罪率较高而变得夜间行走不安全。你对这个说法的看法是下列哪一个？

- (1.) 完全不同意； (2.) 有些不同意； (3.) 有些同意；
(4.) 完全同意； (99.) 不知道或不好确定

8. 在你所居住的社区内，由于道路的车流量很大以致在道路上步行变得有些困难或不方便。你对这个说法的看法是下列哪一个？

- (1.) 完全不同意； (2.) 有些不同意； (3.) 有些同意；
(4.) 完全同意； (88.) 在我居住社区不适用 (99.) 不知道或不好确定

9. 你看到在所居住的社区内，许多人都会积极锻炼身体，比如散步、慢跑等体育活动。你对这个说法的看法是下列哪一个？

- (1.) 完全不同意； (2.) 有些不同意； (3.) 有些同意；
(4.) 完全同意； (99.) 不知道或不好确定

10. 在社区内步行时，能欣赏到许多让人轻松或感兴趣的事情。你对这个说法的看法是下列哪一个？

- (1.) 完全不同意； (2.) 有些不同意； (3.) 有些同意；
(4.) 完全同意； (99.) 不知道或不好确定

11. 你家有几辆性能良好的机动车（汽车、摩托车等）？ _____ 辆（请填写具体数量）；

(99.) 不知道或不好确定

12. 在你所居住的社区内，有很多四岔路口的马路。你对这个说法的看法是下列哪一个？

- (1.) 完全不同意； (2.) 有些不同意； (3.) 有些同意；
(4.) 完全同意； (88.) 在我居住社区内没有马路； (99.) 不知道或不好确定

13. 在你所居住社区内，道路的人行步道维护的良好、并且没有障碍物影响到行人走路。你对这个说法的看法是下列哪一个？

- (1.) 完全不同意； (2.) 有些不同意； (3.) 有些同意；
(4.) 完全同意； (99.) 不知道或不好确定

14. 在你所居住社区内或周围，马路的自行车道维护的良好、并且没有障碍物影响到骑自行车。你对这个说法的看法是下列哪一个？

- (1.) 完全不同意； (2.) 有些不同意； (3.) 有些同意；
(4.) 完全同意； (99.) 不知道或不好确定

15. 在你所居住社区内，由于马路上车辆量很大，让人觉得骑自行车比较困难或不方便。你对这个说法的看法是下列哪一个？

- (1.) 完全不同意； (2.) 有些不同意； (3.) 有些同意；
(4.) 完全同意； (99.) 不知道或不好确定

16. 在你所居住的社区内，由于犯罪率的原因，让人白天出去散步、步行觉得不安全。你对这个说法的看法是下列哪一个？

- (1.) 完全不同意； (2.) 有些不同意； (3.) 有些同意；
(4.) 完全同意； (99.) 不知道或不好确定

17. 在你家附近，有许多可以轻松步行就到达的场所。你对这个说法的看法是下列哪一个？

- (1.) 完全不同意； (2.) 有些不同意； (3.) 有些同意；
(4.) 完全同意； (99.) 不知道或不好确定

※ 所有调查问题已经结束，请你检查一下是否存在漏缺项，如确认每一题都进行了回答，请你填写好调查日期，谢谢！※

调查日期： _____年 _____月 _____日