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Test–Retest Reliability of a Preadolescent Environmental Access to Physical Activity Questionnaire

Heather Elizabeth Erwin

Background: Physical activity behavior is an important aspect of overall health, and it is important to understand determinants of physical activity in order for children to accumulate the recommended levels. The ecological-systems theory describes the relationship between individuals and their contexts, suggesting that environment affects physical activity behaviors. Researchers should measure children's access to physical activity to determine environmental influences. At the time of data collection, however, no reliable questionnaires had been created for measuring children's access to physical activity. ***Methods:*** Students from grades 4 and 5 completed a physical activity environmental-access questionnaire on 2 occasions, approximately 7 to 10 days apart. ***Results:*** The questionnaire appeared appropriate for children age 9 to 12. The lowest reliability was found with items located in the school environment. ***Conclusions:*** This questionnaire is a suitable tool for examining children's physical activity supports and inhibitors.

Keywords: children, home, neighborhood, school

Physical activity is an important aspect of children's overall health. Youth who are highly active generally have healthier bones and muscles, improved blood pressure and cholesterol levels, reduced anxiety and stress, and higher self-esteem.[1] Despite the numerous positive outcomes of physical activity, research indicates that most youth today do not meet the recommended 60 minutes or more of physical activity per day.[1] Because physical inactivity during childhood tracks into adulthood,[2] the finding that today's youth are inactive overall reinforces the prediction that children of this generation will be the first to have shorter life expectancies than their parents.[3]

One area of interest with regard to physical activity in youth is its determinants. Common knowledge would suggest that individuals who have access to an abundance of physical activity supports would, in turn, be more physically active. Some studies examining environmental facilitators of youth physical activity support this idea[4-6]; other research, however, shows that access has little to no relationship with

The author is with the Dept of Kinesiology and Health Promotion, University of Kentucky, Lexington, KY 40506-0219.

youth physical activity.[7] It has also been found that boys and girls perceive equal access to physical activity.[8]

The ecological-systems theory[9-10] describes the relationship between an individual and his or her surroundings. It posits multiple levels of environmental influences that affect behavior, including the microsystem, mesosystem, exosystem, and macrosystem levels. Microsystems are direct interactions such as relations with siblings, friends, or parents. Many microsystems, as well as the environmental context, make up larger ecological systems called *mesosystems*. Examples of mesosystems could be the home, school, or neighborhood.[11] Exosystems are liberties or constraints in the environment that manipulate actions occurring in microsystems and mesosystems. Examples of exosystems include parental rules or recommendations for physical activity. The fourth level, the macrosystem, encompasses all other levels and incorporates societal issues and cultural traditions, which guide the microsystems and macrosystems. For instance, there might be circumstances in which girls may only wear dresses and skirts, which prevent them from being as physically active as those who wear shorts.[10,12] Figure 1 provides a description of the relationships between the 4 levels of the ecological-systems theory.

The ecological-systems theory explains how behavior, such as physical activity, is affected by the environment and how the surroundings and physical activity interact with each another.[12] A child's environment is composed of family members and the school in the community and society.[13] Physical activity behaviors occur

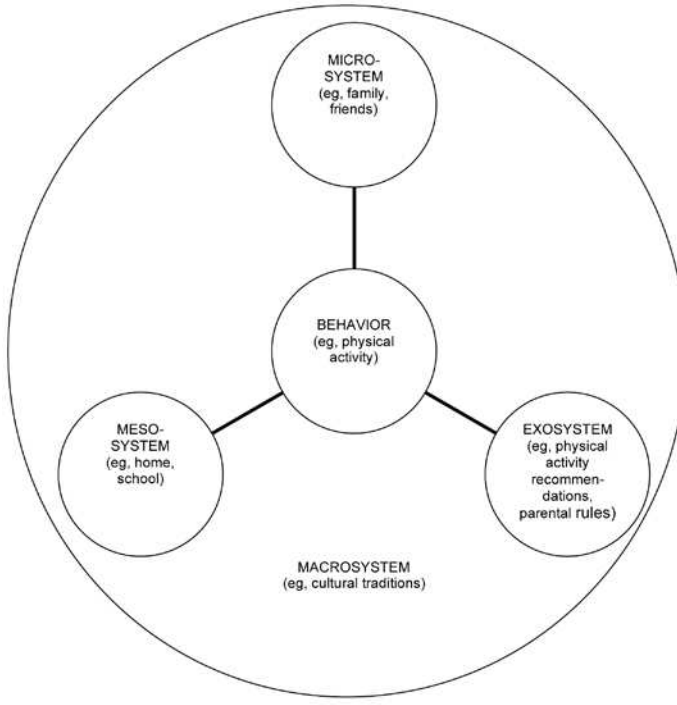

Figure 1 — Relationship between levels in the ecological-systems theory.

when demographic and environmental variables interact, affecting physical activity patterns.[14] Parents, siblings, teachers, and the built environment, among others, affect a child's activity level. Research indicates that the amount of time children spend outdoors correlates highly with their physical activity.[6] Children's physical activity levels are negatively affected when their parents do not allow them to play outside after school. This is an example of how the social environment, or exosystem, influences behavior. The ecological-systems theory is an appropriate framework for this study because the questionnaire of interest measures whether children have access to a variety of environmental variables that influence physical activity.

Because the multiple benefits of physical activity have been established, it is valuable to determine specific aspects of the environment that encourage more of it. In addition, more research examining the relationships between access and physical activity is needed. At the time this study was conducted, there were no reliable environmental-access questionnaires for preadolescent children. Since then, 1 physical activity environment questionnaire designed for children has established reliability.[15] That questionnaire, however, examines access in only the home and neighborhood environments; it does not include school environments. The purpose of this study, therefore, is to determine reliability of a questionnaire designed to assess 9- to 12-year-old children's access to physical activity at home, in the neighborhood, and at school. A secondary purpose was to examine differences in access by gender.

Method

Participants

Before participant recruitment, I received institutional approval for the protocol and obtained informed consent from all individuals who participated in the survey along with their respective parents or guardians. A convenience sample of 4th- and 5th-grade children from 2 elementary schools in the Midwestern United States was selected to take part in the study. Participants included 64 children (20 boys, 44 girls) age 9 to 12 (mean = 10.27, SD = 0.74). All 4th- and 5th-grade students in both schools were invited to participate. Only those returning informed-consent forms were included in the procedures.

Instrument and Procedures

Preadolescent Environmental Access to Physical Activity Questionnaire. A self-report instrument was drafted from 2 reliable questionnaires to assess children's environmental access to physical activity. The preliminary instrument had 4 subsets of items: home environment, neighborhood environment, convenient facilities, and school environment. The subsets of home, neighborhood, and convenient facilities were based on research related to perceived environmental variables and physical activity in young adults.[16] The questionnaire used in this study was modified from the version published by Sallis and colleagues[16] to be appropriate for 9- to 12-year-old children. Most of the content remained the same; some items, however, were deleted from the original version (eg, toning devices, golf course), and others were added (eg, basketball hoop, skateboard) in order to adapt the questionnaire for children of this age group. The original questionnaire was valid and reliable.[16]

The school-environment subset was adapted from a questionnaire designed for high school students.[17] The original questionnaire included visual analogue scales, and participants responded to each statement by placing an X along a line ranging from 0 (*strongly disagree*) to 10 (*strongly agree*). The school-environment items in the questionnaire used for this study were modified to be arranged in checklist format. Some options in the school-environment category included grassy playground, jungle gym, and gymnasium.

After modifications from the 2 reliable questionnaires mentioned previously, the final questionnaire format developed for use in this study was a checklist with 5 sets of questions (home, neighborhood, convenient facilities, school, and personal information). Participants responded by placing a check mark on the line next to the item if they had access to it. The home-environment section presented 17 choices, and the neighborhood-environment segment presented 9 choices. In addition, 2 questions were related to neighborhood safety and type (eg, residential or commercial). The neighborhood-safety question used a Likert scale requesting participants to circle the number corresponding to how safe they felt in their neighborhood. The type-of-neighborhood question asked the participants to circle whether their house was in an area of "mostly houses," "a mix of houses and buildings," or "mostly buildings." The section on convenient facilities offered 11 choices, and the school-environment portion presented 12 choices. There was also a personal-information section requesting sex, age, birth date, grade, race, school, and street address. This part of the questionnaire was used to collect demographic information on all participants. For sample items from the questionnaire, see the appendix.

Administration of Questionnaire. The questionnaire was administered on 2 occasions approximately 7 to 10 days apart in May 2005. It took roughly 10 minutes for children to finish. Participants completed the questionnaires during physical education class time. The researcher and physical educator were available to answer any questions.

Data Analysis

Three sets of analyses were conducted. First, kappa statistics (κ) and percent agreement between responses from trial 1 to trial 2 were performed to determine test–retest reliability for each individual item on the questionnaire. Kappa statistics are used with nonparametric data and indicate consistency by question. Responses to dichotomous variables using κ were defined using agreements from previous literature.[18] Agreements included *acceptable* (.40–.60), *good* (.60–.75), and *excellent* (.75–1.0). An alpha level of .01 was used for reporting all significant values according to κ.

Second, intraclass coefficients using the model C method[19] examined the reliability by subcategory (eg, home, neighborhood, school). Participant responses were summed by subcategory, resulting in continuous variables, and the total was compared from trial 1 to trial 2. Absolute agreement among individual responses was measured. Reliability was considered adequate if the alpha level was greater than .70.[20]

Third, Fisher exact tests were conducted to examine the differences in access to physical activity supports and barriers by gender. Fisher exact tests were used to determine significance levels for each item on the questionnaire because of the small sample size and nonparametric data. An alpha level of .01 was used to report significant differences.

Results

Overall, the questionnaire seemed suitable for children age 9 to 12. Participants had few questions for the researchers, and most missing responses were for items requesting personal information such as ethnicity. Results from test–retest reliability and Fisher exact tests are shown in Table 1. Participants showed the most reliability in answering the neighborhood and convenient-facilities items; all physical activity supports in these categories were statistically significant according to κ. Only 1 item in the home-environment section and 2 items in the school-environment section did not show κ significance. Those items will be described later. Participant answers showed statistically significant reliability for the remaining physical activity supports. With regard to physical activity inhibitors (eg, television, high crime rates), all were significantly reliable, yet 1 had a poor κ value. These will be discussed in each respective section. There were no significant differences in access by gender.

Home Environment

The home-environment physical activity promoters all indicated κ significance except 1, sports equipment, which showed a poor κ value (.25). The percent agreement among participants for the sports-equipment-at-home item, however, was 92.1%, indicating that only 5 participants (7.9%) did not demonstrate reliable answers from trial 1 to trial 2. The remaining home-environment items had κ values ranging from *good* (.66) to *perfect* (1.0), with percent agreements ranging from 88.9% to 100.0%.

Table 1 Test–Retest Reliability of Physical Activity Environments

Item	Kappa (κ)	*P*	% yes agreement (n)	% no agreement (n)	Fisher exact test (*P*)
Home					
backyard	.79	.00	100.0 (60)	66.7 (3)	.52
basketball hoop	.83	.00	95.7 (47)	87.5 (16)	1.00
bicycle	.66	.00	98.4 (62)	100.0 (1)	.52
dog	1.00	.00	100.0 (31)	100.0 (32)	1.00
front yard	.79	.00	100.0 (60)	66.7 (3)	.52
pogo ball or stick	.74	.00	97.6 (41)	72.7 (22)	.35
running shoes	.83	.00	93.9 (49)	92.9 (14)	1.00
scooter	.84	.00	100.0 (44)	78.9 (19)	.76
siblings (brothers or sisters)	.84	.00	100.0 (50)	76.9 (13)	.15
skateboard	.76	.00	95.0 (20)	86.0 (43)	1.00
skates (roller, in-line, or ice)	.88	.00	95.7 (46)	94.1 (17)	.04
sports equipment (balls, rackets, jump ropes)	.25	.03	93.4 (61)	50.0 (2)	.16
swimming pool	.84	.00	100.0 (10)	94.3 (53)	1.00
trampoline	.70	.00	70.6 (17)	95.7 (46)	.52

Item	Kappa (κ)	*P*	% yes agreement (n)	% no agreement (n)	Fisher exact test (*P*)
Home (inhibitors)					
computer	.79	.00	98.4 (61)	100.0 (2)	1.00
electronic games	.85	.00	98.0 (50)	84.6 (13)	.01
television	.38	.00	96.7 (61)	50.0 (2)	1.00
Neighborhood					
enjoyable views	.61	.00	91.4 (35)	67.9 (28)	.57
frequently see people walking or exercising	.52	.00	94.4 (54)	55.6 (9)	1.00
friends	.42	.00	85.2 (54)	66.7 (9)	.32
sidewalks	1.00	.00	100.0 (51)	100.0 (12)	.32
street lights	.87	.00	93.5 (31)	93.8 (32)	.18
Neighborhood (inhibitors)					
heavy traffic	.89	.00	90.9 (11)	98.1 (52)	.28
high crime	.65	.00	66.7 (3)	89.3 (60)	.55
hills	.59	.00	73.7 (19)	86.4 (44)	.77
loose dogs	.55	.00	61.5 (13)	92.0 (50)	1.00
Convenient facilities					
basketball court	.52	.00	76.9 (26)	75.7 (37)	.41
beach, lake, or creek	.76	.00	83.3 (24)	92.3 (36)	.39
bike lane or trails	.43	.00	78.6 (28)	65.7 (35)	.77
field (soccer, football, softball)	.71	.00	87.9 (33)	83.3 (30)	1.00
public park or playground	.72	.00	90.2 (41)	81.8 (22)	.40
public recreation center (YMCA)	.41	.00	66.7 (3)	93.3 (60)	1.00
running track	.42	.00	83.3 (6)	84.2 (57)	.52
skating rink or ramp	.45	.00	60.0 (5)	93.1 (58)	1.00
swimming pool	.52	.00	65.0 (20)	86.0 (43)	.38
tennis courts	.64	.00	80.0 (20)	86.0 (43)	.57
walking or hiking trails	.48	.00	76.5 (17)	78.3 (46)	.78
School					
blacktop playground	.20	.10	96.6 (58)	20.0 (5)	1.00
grassy playground	.74	.00	86.1 (36)	88.9 (27)	.41
gymnasium or cafeteria	.32	.01	94.4 (54)	33.3 (9)	1.00
intramurals	.41	.00	82.4 (17)	67.4 (46)	.28
jungle gym (swings, monkey bars, slides)	.30	.01	95.1 (61)	50.0 (2)	1.00
physical education (PE)	.52	.00	94.4 (54)	55.6 (9)	.69
playing fields (soccer, football, softball)	.72	.00	80.6 (36)	92.6 (27)	.42
running track	.60	.00	78.3 (23)	82.5 (40)	.58
school sports teams	.75	.00	86.7 (30)	87.9 (33)	.29
sport or exercise equipment	.34	.01	80.0 (35)	53.6 (28)	.08
school swimming pool	–.04	.75	0.0 (3)	96.7 (60)	.09
tennis courts	.38	.00	25.0 (4)	100.0 (59)	.30

Physical activity barriers at home all indicated κ significance. Their κ values ranged from .38 (television) to .85 (electronic games), with percent agreements varying from 95.2% to 98.4%. Despite the low κ value for television, the participants showed an agreement of 95.2%, indicating that only 2 participants (4.8%) changed their responses from trial 1 to trial 2. For the computer item, only 1 participant changed his or her response.

Neighborhood Environment

The physical activity promoters in the neighborhood environment were all statistically significant according to κ values. They ranged from *acceptable* (.42) to *perfect* (1.0). Percent agreements among items from trial 1 to trial 2 ranged from 81.0% to 100.0%, indicating that most participants gave similar responses on the test and retest.

Physical activity barriers in the neighborhood all indicated κ significance. Their κ values ranged from .55 (loose dogs) to .89 (high traffic), with percent agreements varying from 82.5% to 96.8%. Participants showed more difficulty identifying loose dogs, as well as hills, in their neighborhood, which detract from physical activity.

Convenient Facilities

Despite lower overall κ values, the 11 convenient-facilities items were all statistically significant. The κ values ranged from *acceptable* (.41) to *excellent* (.76), and all items had percent agreements of 71.4% or greater. There were no physical activity constraints listed in this category.

School Environment

School-environment items demonstrated the least strength of reliability, with 6 items showing poor agreement (blacktop playground, gymnasium, jungle gym, sports equipment, school swimming pool, and tennis courts). Even though the κ reliability was low for these items, the percent agreements for 5 of the 6 items were fairly high (85.7% to 95.2%). The only school item showing nonsignificance and a low percent agreement was sports equipment, in which only 43 out of 63 participants (68.3%) matched answers from trial 1 to trial 2. The remaining 6 school items (grassy playground, intramurals, physical education, school field, track, and school sports) were all statistically significant and showed percent agreements ranging from 71.4% to 88.9%. There were no physical activity inhibitors included in the school category.

Reliability by Subcategory

Based on model C intraclass coefficients, 3 of the 4 subcategories showed acceptable reliability. The home-environment subcategory demonstrated the highest overall reliability at .95. Neighborhood and convenient facilities both showed category reliabilities of .86. The subcategory of school environment had the lowest overall reliability with an alpha level of .63.

Discussion

This study examined the reliability of a questionnaire designed to measure children's perceptions of their physical activity access. Not only did it measure physical activity access in the home and neighborhood environments,[15] it also gauged children's perceptions of their physical activity promoters in the school environment. Only 6 of the 49 items appeared to have poor κ values (sports equipment at home and blacktop playground, gymnasium, jungle gym, swimming pool, and tennis courts at school). Of those, sports equipment at home, blacktop playground, and school swimming pool were the only items that did not demonstrate κ significance. With the exception of school sports equipment, all of these items showed high percent agreement from trial 1 to trial 2. The remaining 43 items showed κ significance and demonstrated acceptable percent agreement. It is important to note that values for κ rarely exceed .75 because of the adjustment for chance agreement.[18] Environmental items in this questionnaire, therefore, tended to exhibit high κ values overall.

With regard to overall reliability of each environment subcategory, home, neighborhood, and convenient facilities demonstrated acceptable reliabilities. It is evident that children were able to consistently identify items to which they had access in each of these environments. The school environment, however, did not show acceptable reliability overall. This might be a result of misunderstandings of some of the terminology used to describe school items. Another possibility is that participants might have confused items in each category. For instance, swimming pool was listed under the home, neighborhood, and school environments.

It was found that access did not differ by gender. This is consistent with previous literature[8] and suggests that both boys and girls have comparable perceived access to resources. One disturbing point remains; it is well known that females are less active than males overall.[1,21] Despite the fact that both genders perceive fairly equal access to physical activity promoters, there are still differences in overall physical activity levels between the genders. Perhaps girls need to have additional physical activity supports to enhance their engagement, or perhaps they need to be introduced to more ways to make use of the supports they have.

Future research should examine the validity of children's perceptions of their physical activity supports and inhibitors. It would also be valuable to determine the frequency of use of physical activity supports to which children have access. Children who have opportunities to be active might not necessarily take advantage of them. Access to supports and corresponding physical activity levels should be examined by gender. The results of this study indicate that the items on this questionnaire were appropriate for children age 9 through 12 to understand and self-assess reliably. In addition, several, if not all, of the items on this questionnaire appear to be appropriate to include when studying environmental influences on children's physical activity levels.

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Appendix

Preadolescent Environmental Access to Physical Activity Questionnaire

Home Environment

Please check the items you have access to in your home or yard.

_____ a. backyard
_____ b. basketball hoop
_____ c. bicycle
_____ d. computer
_____ e. dog
_____ f. electronic games
_____ g. front yard
_____ h. pogo stick or ball
_____ i. running shoes
_____ j. scooter
_____ k. siblings (brothers or sisters)
_____ l. skateboard
_____ m. skates (roller, in-line, or ice)
_____ n. sports equipment (balls, rackets, jump ropes)
_____ o. swimming pool
_____ p. television
_____ q. trampoline
_____ r. other: Please list _____ _____

Neighborhood Environment

Please check all of the things found in your neighborhood.

_____ a. dogs that are loose
_____ b. enjoyable views
_____ c. frequently see people walking or exercising
_____ d. friends
_____ e. heavy traffic
_____ f. high crime
_____ g. hills
_____ h. sidewalks
_____ i. street lights
_____ j. other: Please list _____

How safe do you feel walking in your neighborhood during the day?

(1 = very unsafe; 5 = very safe)

1 2 3 4 5

Is your neighborhood:

1. residential (mostly houses)
2. mixed commercial and residential (a mix of houses and buildings)
3. mainly commercial (mostly buildings)

Convenient Facilities

For each of these places where you could be physically active, please check if it is on a route you walk regularly or within a 5-minute bike ride from your home.

_____ a. basketball court
_____ b. beach, lake, or creek
_____ c. bike lane or trails
_____ d. playing field (soccer, football, softball, etc)
_____ e. public park or playground
_____ f. public recreation center
_____ g. running track
_____ h. skating rink or ramp
_____ i. swimming pool
_____ j. tennis courts
_____ k. walking or hiking trails
_____ l. other: Please list _____

School Environment

Please check the items you have access to in your school.

_____ a. blacktop playground
_____ b. grassy playground
_____ c. gymnasium or cafeteria
_____ d. jungle gym (swings, monkey bars, slides, etc)
_____ e. physical activity intramurals
_____ f. physical education
_____ g. playing field (soccer, football, softball, etc)
_____ h. running track
_____ i. school sports teams
_____ j. sport or exercise equipment
_____ k. swimming pool
_____ l. tennis courts
_____ m. other: Please list _____